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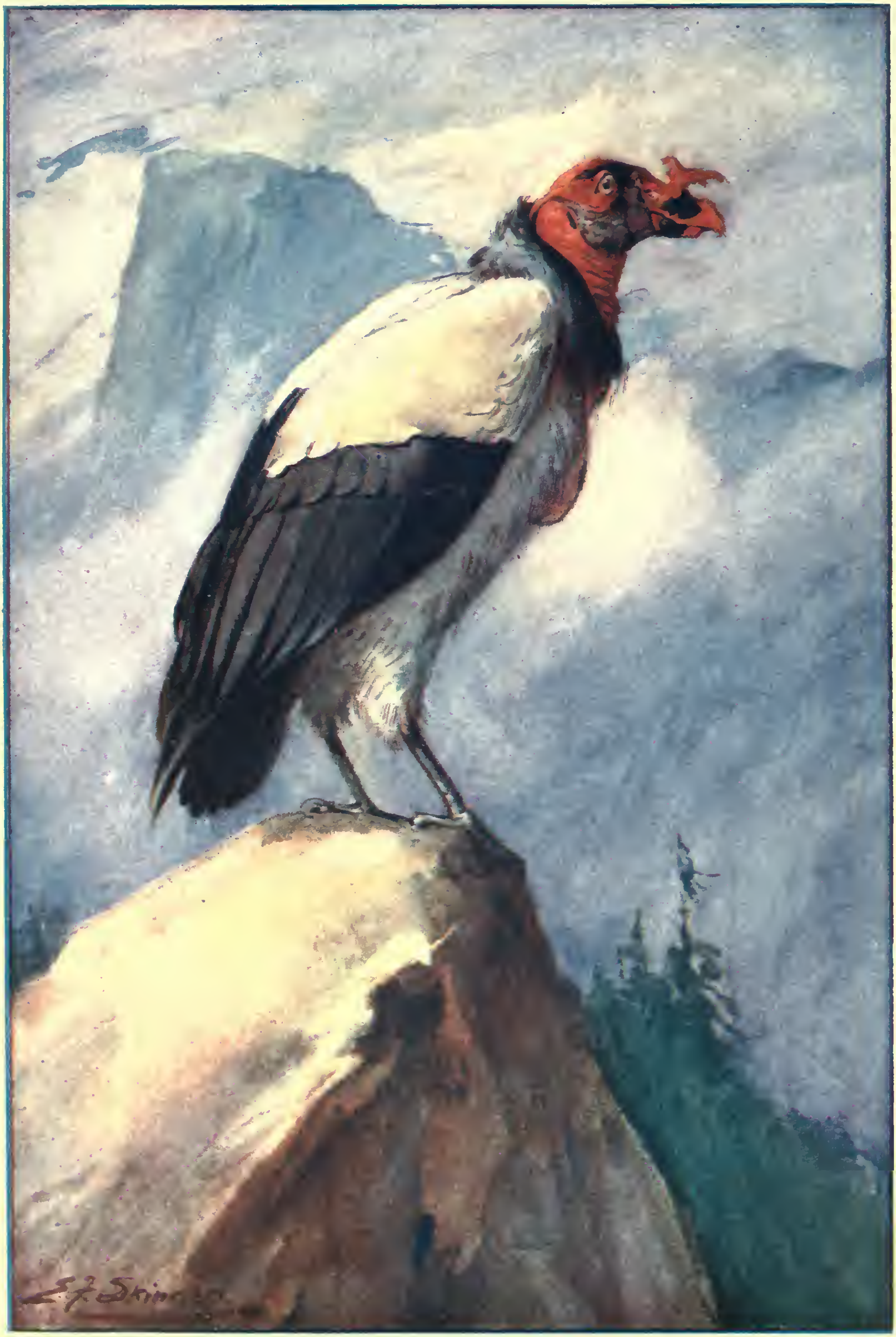
THE KING AMONG THE MOUNTAIN PEAKS



THE KING CONDOR, WHICH IS FOUND A MILE HIGH IN THE FORESTS OF AMERICA

The Everyday Library

For Young People

EDITED BY

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Editors of the Book of Knowledge

Beast, Bird and Flower

☆

NOVEL AND INTERESTING ACCOUNTS
OF ANIMAL, BIRD AND PLANT LIFE

EDITED BY

ERNEST INGERSOLL

President National Association of Audubon Societies
Author of "The Life of the Animals"
"The Wit of the Wild," etc.

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Beast, Bird and Flower

"Let us wander in nature's great fair garden,
and cull her precious secrets."

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A very angry Australian barn-owl trying to look fierce

THE FUNNY THINGS ALIVE

"THE world is so full of a number of things," said Robert Louis Stevenson, "that I think we should all be as happy as kings." Well, it is true that the world is full of things, but they are not quite all happy things. Some of them are splendid and some are mean; some are noble and some are foolish; some are lovable and some are hateful; some are beautiful and some are ugly; some are terrible, and others are funny. Let us look at a few of the funny things that are alive.

Animals cannot imagine how very funny some of them are in appearance. They never dream how we laugh at them. Perhaps they would be very angry if they really knew how odd we think they are; perhaps they think that we are very odd.

The intelligent animals, like the dog and the monkey, do not mind our laughing if they try to make us laugh; a dog will deliberately do things to amuse us. He loves to pick up a stick and pretend to give it to us, then rush off just as we get near him. And a cat, which is a superior animal, in its own estimation, will deign at times to amuse us. A pet cat loves to rush out from some hiding-place, scamper across a child's feet, give her a pat or a slap with his paw, and scurry away. There was a monkey which would fly at a man who was afraid of it, and pretend to bite him and do all sorts of wicked things, simply to amuse its owner. The monkey knew that it was thought clever and amusing, and would never molest its victim unless its owner were present to laugh and applaud.

But if we laugh at a monkey jeeringly, he is enraged. Cats and dogs seem to have the same feeling of anger in similar circumstances. They like us to laugh when they try to make us laugh, not when they are cross.

We may take it, therefore, that the clowns of Nature's family—the things made on comical lines—would be indignant if they knew what we really think about their appearance. But they have no idea. They are as satisfied with their ugliness as we are with what we think our good looks. The probability is that they think us just as funny as we think them.

But here we can have our own laugh at the funny creatures, and see how odd they really are. Take the hooded spider-monkey, the little Tommy Noddy of the monkey folk—almost all legs and no body, with a head so tiny that really his penthouse of hair seems almost wasted. But was ever there such a tail? When he is not using it to swing by in the trees, he carries it curled something like a capital "S," or a fancy teapot-handle. In such circumstances it is his balancer. But it is always feeling about for something to clutch, like a trunk growing out of his spine instead of from his head.

Well, that is the spider-monkey's idea of dashing beauty, and for worlds he would not have his spidery legs an inch shorter, or his tail less curly-whirly. If they were, the ladies of his family would not love him, and he would be a sad and lonely monkey. If ever he took to combing his hair, he would probably hold the comb with his tail, for that tail is as good a grasping instrument as our hands. Talking of brush and comb reminds us of a monkey—the saki—which looks as if he really did keep those useful things on his toilet-table in the trees of Guiana. There are two kinds of saki, and while some have their hair parted scrupulously down the middle of the head, others have the hair radiating from the centre, like the spokes of a wheel, as we see in our picture. This saki looks as if he is doing his best to appear like a little gloomy old man. His forehead is rather yellow, and has a black streak, and he has whiskers and a beard and moustache, just like a tiny man.

THE HOODED SPIDER-MONKEY

If the saki caught you laughing at him, he might think to himself, if he could think any such thing: "What would they say, then, to that extraordinary cousin of mine, the tarsier?" The tarsier is in the lemur group, the oldest of all the monkey types. It has extraordinarily long toes and fingers, each with little pads at the end as if the tarsier had been walking over damp clay and some of it had stuck. Its ears are so big, and its wide-staring eyes so prominent, that you could fancy it was trying to look as terrible as possible before crying "Boo!" at you. If that did not sufficiently alarm you, the small jester would spring straight up into the air before your very nose

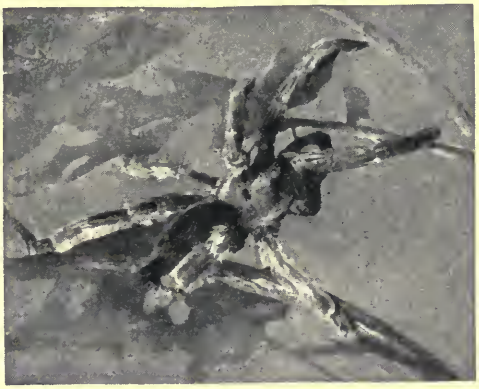
THE SAKI TRYING TO LOOK LIKE AN OLD MAN

From a photograph by W. S. Berridge

Large as are the ears of the tarsier, they are small in comparison with those of the long-eared jerboa. Here we have a very funny little fellow, looking like a big mouse on stilts which has borrowed the ears of a bat. When he rears himself upon his hind legs you might fancy that he is making you a comical bow in response to the laughter with which you have greeted him. But you must laugh quickly or not at all, for he will be off on those long hind legs of his, leaping like a kangaroo, and at such a rate that you will need to ride a very swift horse indeed to overtake him.

There is a curious creature in South America who will not so swiftly leave us, and that is the animal Don Quixote, which, out of politeness to his family, we call the apar, or the three-banded armadillo. It is impossible not to smile at him. Here he is, after all these centuries in which armour for men and animals has been out of fashion, still trotting about like our dear old knight of the rueful countenance, armed from head to foot. He has plates of armour on his head, on his back, his legs, his tail, and you would think, to look at him, that he had three belts round his waist on which to hang swords as true as King Arthur's.

But our new friend is no warrior. Sneeze or clap your hands, and all his suggestion of warlike valour forsakes him. He shrinks up, curls into a ball, tucks his nose between his toes, and there he is, as hard and round and impenetrable as a cannon-ball. Our knight in armour is about as brave as Tweedledee and Tweedledum were when the old crow flew over their heads. And he himself could never hurt anybody, for his mouth is so small that if you keep one you must actually cut his food up into little pieces, or he will never be able to eat it.


THE HUNGRY BIRD-EATING SPIDER

There are frogs and toads more bold and alarming than our friend the armadillo, some of them, like the horned frogs of Argentina and Brazil, making great leaps to attack an enemy, and giving quite a serious nip upon completing their jump. But the frog family includes some clownish-looking species, of which our West African short-headed frogs shall serve for an example. With their funny little heads and puffed-out bodies, they look as if they went through life eating far more than was either polite or good for them.

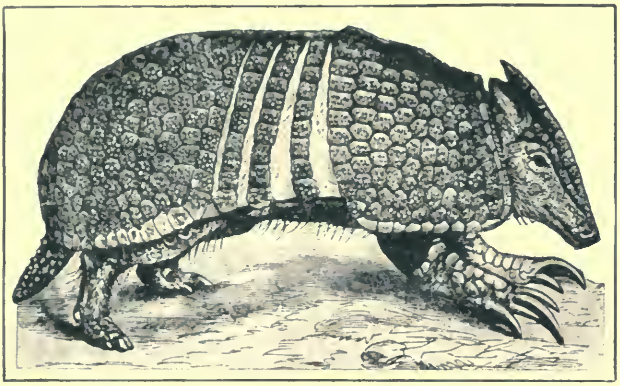
A RUFF WITH HIS SCARF

These frogs wear a look of penitence, and so we feel that we ought to grant them pardon, although we know that they have not sought it, nor done anything that needs pardoning. But when we pass on to the reptiles, we at once meet a specimen, in the frilled lizard, who begs no one's pardon, but seems in a rage with everybody, and determined to make us all tremble before him. He really has a fearful look. He believes in scouring about, frightening everything and everybody. He is a comical fellow when you understand him. He could not hurt your finger if he bit his hardest, for he has no teeth, only horny plates, but he tries to make us think he is a terrible Turk, and actually makes faces at us. He has a sort of umbrella-like frill around his neck, which he can put up or close at will. When he wishes to alarm us, he flicks open his frill, which is a surprising trick, and opens his mouth to its widest gape, so that we feel thankful we have not been eating of the cake which made Alice small.

A GROUP OF PIXIE-LIKE TARSIERS

But soon we realise that he does not mean to fly at us or eat us up. The funny little fellow knows that he has a reputation for looking formidable—experience teaches him that; and he has learned that by opening and shutting his extraordinary frill and smartly snapping his jaws he can make himself ten times more terrifying in appearance. He lives in Australia, where many funny animals have grown up; and as he has had nothing worse than simple-minded kangaroos or animals as harmless to deal with, he has found his trick answer well. Probably they have thought him as awful a fellow as the giant who is supposed by foolish people to lie beneath a volcano, and by his restless turnings to cause volcanic eruptions and earthquakes. And what seems a laughable performance to us must seem the very height of terrifying power to animals of the frilled lizard's own size which disturb him.

But when we have had our laugh at Master Lizard, let us spare him one little bow of reverence, for he is the last on earth of the vast families of reptiles that once walked upright on two legs. He can still run, and does run, in this manner. It is splendid and wonderful that this little creature should be alive after all the millions of years in which Nature's family has been changing. Australia's peculiar situation has kept him alive. All connection with other lands were broken down millions of years ago, before the great flesh-eating animals appeared upon the earth, and so the little lizard has been all this time frightening, or trying to frighten, the rest of his neighbours, by pretending that he has powers which he does not possess and never will.



THE ARMOUR-CLAD APAR, OR THREE-BANDED ARMADILLO

What a monument of gravity and wisdom the chameleon appears! Poised upon the branch of a tree, he looks like wisdom carved as a little statue. With his eyes slowly revolving independently of each other, upon a plan which a schoolboy would give a year's pocket-money to be able to copy, he surveys all the world about him with the most impressive air of knowledge and judgment and wisdom.

But what a change-coat he is! He makes his colour match his surroundings. If the prevailing tone is yellow, his skin becomes yellow; if it is green, he turns green; if it is shaded, compounded of green and shadows, he becomes mottled. There is no fixing the creature to any one hue. And while it all happens there is never a smile upon his face. He is as serious as the Sphinx. And after all his watching and care, what follows? He suddenly shoots out an extraordinarily long tongue, and with it catches a fly or other small insect. Such gravity and dignity and stolid care never went to so small a task. Well, the insect is as important to the chameleon as is a buffalo to a lion. His way of living is the best that he has been able to discover, and he has learned to do something that we have not, for he can blush green and yellow.

Many strange figures excite our merriment in the reptile world. Some of the lizards have been painted by Nature with the most extraordinary colours. Where we find the most staring tones prevailing, we get at the true taste of the species, for experience teaches us that in certain forms of animal life startling hues are appreciated, and that the creature in such a branch of life which has the gayest coat will be the one to win most favour.

THE LONG-EARED JERBOA TRYING TO BALANCE HIMSELF

But there is one of the tribe which has left gaudy patterns alone, as if believing that it is sufficiently handsome already, and so precious that it must arm itself as never a pantomime giant was armed. This is a lizard of Australia named the moloch. Compared with the moloch's coat we may say that the coat of the hedgehog is almost smooth. The moloch simply bristles with spines and sharp-pointed knobs from the tip of its tail to the point of its snout.

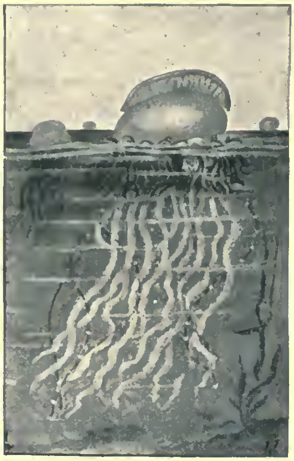
Now, if we see a man travelling abroad heavily armed, we think to ourselves, "That man must be guarding some rich treasure of which he fears to be robbed." And seeing the moloch we fancy that it must expect to encounter peril every time it puts its head out of its hiding-place.

THE FAT LITTLE AFRICAN SHORT-HEADED FROGS

But this reptile is an impostor. It has frightened generations of men into the belief that it is one of the terrors of creation, and the wildest stories have been told of it. But it is really harmless, and would not hurt anybody unless it were picked up, when it would prick, though even a thistle can do that. So we will let him go his way, tripping innocently along and pretending to be a little monster of evil, though he is not a single bit more terrible than the harmless little gecko. This small lizard is as clever as an ant, for it can trot up a wall or nip up a window-pane without the least fear of falling. In that way it runs about the houses in Egypt and Palestine, doing really capital work for the householder by snapping up flies and other horrid insects. But, oh, the tales the natives tell us about this little sucker-footed lizard! "Don't touch him, and don't let him touch you; if he runs across your flesh you will be laid low with a terrible disease," they say. Their fathers and mothers said the same thing, and their children will probably be repeating it when we are old and past laughing at them. Yet the gecko is as harmless as our dear little shrew mouse, which is said by simpletons to cause illness to man or beast whom it crosses—an old story brought from England. The editor of an English magazine was once sitting in an Egyptian garden eating a Christmas orange which he had plucked from the tree in whose shade he was resting; and as he ate his luscious fruit little geckos were popping up and down the walls behind and beside him, and he did his best to catch one for his little girl who was awaiting his return at home. And *he* does not pick up poisonous things.

THE DANGEROUS-LOOKING BUT HARMLESS WALL-GECKOS

There is not much humour for most of us in a spider. Valuable ally of man as the spider is, he is so stealthy and terrible that he has become a by-word expressing cunning and cruelty. Yet there is a member of the spider family which little children in India love to make a pet of, as if he were the gentlest thing alive. They tie string round his waist and lead him about like a little dog. Yet he is a terrible thing, for he eats birds! He has a body two or three inches in length, and the width covered by his legs when he straddles is seven inches. He builds a very thick web in the trees, in which little birds are caught. He pounces down upon them as a garden spider springs upon a bluebottle, and kills them with his cruel jaws, then drinks their blood. Do spiders laugh? one wonders. If so, this spider must have a chuckle when he has got away from some hand stretched forth to capture him. For his legs are covered with hairs, like a crab's, and those hairs, being short and very sharp, run into the flesh and cause misery for days, just as do the little broken pieces of spun glass which some of us may have carelessly handled.



THE EXTRAORDINARY PORTUGUESE MAN-OF-WAR

The birds all sprang from reptiles, so we must not be surprised that in their world we find extraordinary colourings. Some of these are exquisitely blended, others are simply ludicrous. Look at the toucans, the birds with the immense beaks; their feathers and flesh and bills represent enough colours to make up a very fair rainbow. But, like our own puffin, and like the great hornbill, their heads are their most remarkable part. The bird is heavy-bodied and weak-winged. Why, then, is it burdened with what seems to be such an enormously weighty beak? The beak is not really heavy; it is marvellously light. It is filled with air-cells, and is as easily wielded as the beak of a little bird. As the bird flies heavily, it was necessary, in order to keep out of harm's way, that it should live in the trees, and eat the flowers and fruit that these yield. But the bird's food grows at the end of branches, or on top, where the twigs are thinnest and incapable of bearing the weight of the toucan.

A FRILLED LIZARD MAKING A GRIMACE

From a photograph by W. P. Dando

This heavy bird cannot feed while suspending itself in the air, as the delightful little humming-bird can, and so it has had to build up a great beak by means of which it can reach its food while perched below upon a safe branch. The hornbill's beak is even more remarkable, for not only has it great length, but it has on top a casque, or sort of helmet. This beak has a similar use to that of the toucan, and serves also a rather comical one. When the mother hornbill is sitting on her eggs in a hole in a tree, the male bird calmly plasters up the opening, leaving only a little hole through which she can thrust her long bill to be fed. He does not let her out until the children are ready to hop about.

What do owls think about as they sit calmly gazing at us? Nobody ever was as wise as they look. Do they sit and wonder how to look wiser, or are they furtively chuckling over the reputation for wisdom which their looks have earned for them? Possibly it is on fat mice and tasty night-roaming insects that they muse. Look at the picture, and, when you meet the original, take a peep when nobody else is looking. He will seem to wink at you, as if to say, "All right, my dear; we understand one another, don't we?" And so we call him the winking owl. There is another bird of the same family, the Australian barn-owl, who will not receive your advances so civilly. He spreads his wings and thrusts out his head as a challenge. "Come on, if you dare!" he means. That is the attitude in which he challenges attack; and beak and talons will make good his share in any battle into which you are unwise enough to thrust your overbold young hand.

THE DIGNIFIED SECRETARY BIRD

A CRESTED GUINEA-FOWL AT REST

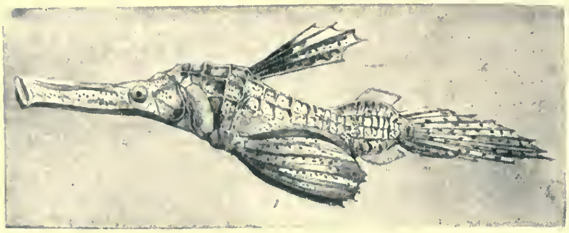
There is not much chance of our seeing hoopoes flying free in America, for they spend the winter in the warm parts of Asia and Africa and the summer in Europe. But we may see them at the Zoo. And every one of us wonders why these birds have such strangely long beaks. The reason is that they dig in turf for the insects which form their food. They have been well called the dry-land snipe. The hoopoe is a good servant to man, and in the East the natives say that the splendid crown of feathers which the bird carries was given him by Solomon for his meritorious labour. But the hawks know nothing about that, and do not scruple to attack the hoopoe. The latter, the moment his keen eyes detect a hawk, lowers his noble crest, spreads out his wings, throws himself flat on the ground, and lo, he is not! He seems to have disappeared into the earth, and what appears like a little bundle of rags alone remains. Would that the bird had as successful a device when a man walks into its haunts with a gun in his hand!

A GREEN-BILLED TOUCAN SHOWING OFF HIS BEAK

Having reached the sea-coast, let us give a moment to the creatures living in the waters beyond it. We can find wonders and humour enough for the seeking. Did you know that our friend the spider-monkey has a rival here? He has, in the delightful little sea-horse, which, lacking hands, of course, cleverly uses his small tail as one. By its action he swims, and when he wishes to rest he clasps some stationary object with it, and there he rests, swinging by his gripping tail as the monkey swings in the tree. The monkey can actually feed himself with his tail, but the sea-horse cannot do that, but draws his food into his mouth by suction. He is called sea-horse because the shape of his head and neck so closely resembles that of the true horse, or, better still, the little figures of horses' heads that we use in chess, with which Alice had such rare adventures in the looking-glass.

There is another sea-horse which our Australian friends entertain that has cultivated all sorts of streamers, so that it beautifully matches the seaweed among which it lives, and so escapes the jaws of hungry fish upon the prowl. But there is a fish which floats with even less labour than the little sea-horse, and that is the sun-fish, a relative of the globe-fish. The latter, when he wants to sail along, simply blows himself up like a small balloon, and floats.

But the sun-fish, with his cheerful, innocent-looking head, takes less trouble. He simply lets his natural buoyancy carry him to the top of the water, and away he floats, a living raft. The wind may blow him, the tide may carry him; he does not mind, he is at home in any waters, except the coldest. It is a good job for him that he is not small enough to go floating into a sort of living cavern that some of us know about, or he would awake from his pleasant dreaming cruise to find himself engulfed by that deceitful villain the angler-fish. It depends where you live what you call this wily trickster. In some places he is the fishing-frog, because of his big frog-like mouth; in other places he is wide-gab, for the same reason. But his nature and habits are always the same. He is not a fast swimmer, but he can catch fish which are. From his ugly head three filaments with glittering tips project. The angler buries himself in the muddy sand at the bottom of the sea, and lets the filaments stand up in the water, where they wave about, and attract the attention of inquisitive fish. They swim up to nibble, as most fish will. But snap go the big hidden jaws, and another good fish has fallen a victim to this ancient but marvellous bit of trickery. Nobody likes the fishing-frog, but he is not quite so vile as the saw-fish, which, with its double-edged weapon, tears open soft-bodied sea creatures and devours them alive. One of these, the Japanese, is quite a small species, but many of them are monsters with saws six or more feet long. Some of the lower animals of the sea are as wonderful to us as the most highly organised. But they are not all easy to handle. The brittle-star, for example, will tax our skill to the utmost; indeed, we cannot catch him alive and whole. He shatters himself into fragments at a touch, like the sudden dissolution of an over-ripe fungus. We cannot get him out of the water whole, try as we may. Even in the water, if anything displeases him, he flies into a rage or a fright, and breaks to pieces. This would be a terrible thing for his whole family but for the marvellous fact that some of the fragments into which he breaks will grow into entirely new star-fishes.


THE FUNNY LITTLE BLUE-FINNED TUBE-MOUTH

THE IMPUDENT WINKING OWL

Sometimes travellers on a tropical sea have been attracted by a pinkish envelope floating peacefully on the waves, taking it to be some sort of sun-fish; and frequently it has been one of those terrible things called the Portuguese men-of-war. Down below that beautiful envelope hang a number of tentacles, or feelers, several feet in length, and they are charged with an irritant poison which stings dreadfully for days. These stings paralyse the small forms of life on which the strange creature lives, so affording it time to take its meal at leisure where there is no chance of the victims escaping. But this is not the only thing in the sea that stings. What of the medusæ, or jelly-fish? They are funny things, indeed, for they are simply envelopes of water, so far as the ordinary eye can see. Carry a barrow-load home and leave them

THE GREAT FRIGATE BIRD IS AMUSED

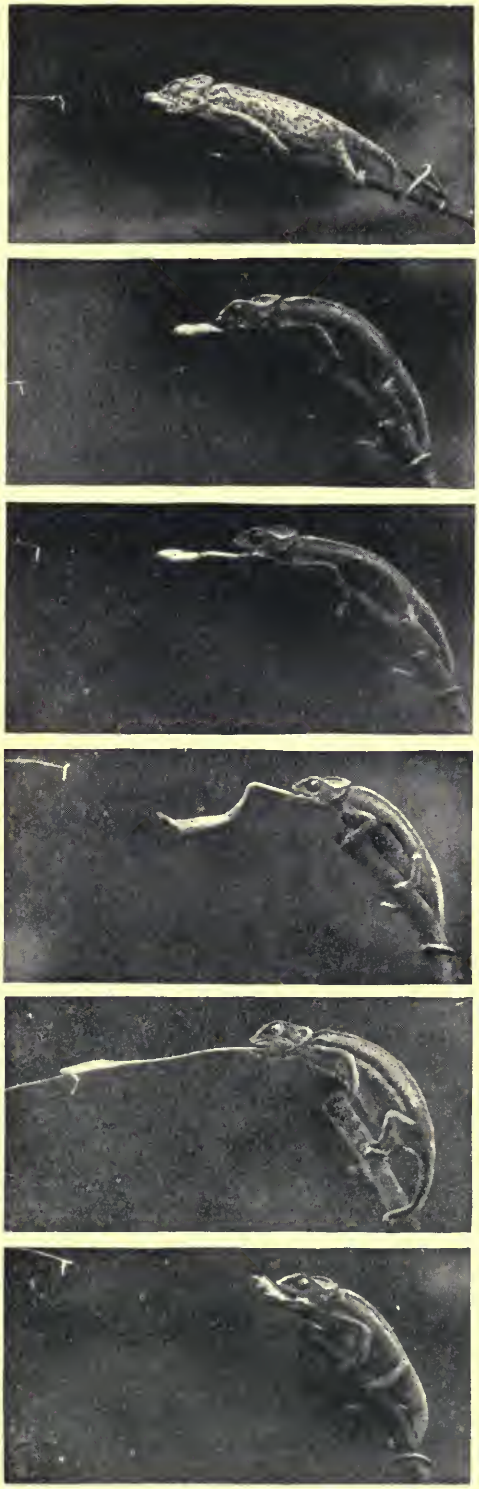
in the open, and they will vanish into thin air, leaving only a film to show where they have been. Yet they can sting and can give the loveliest light in the sea at night, the light we call phosphorescent.

We see many sorts on our own coasts; we see uncountable swarms of them floating on the sea when we are on a ship. Some are quite tiny things; others are monsters, with a bell, or upper part, seven or eight feet across, and with feelers trailing through the water as much as 200 feet long.

And every inch of these long tentacles can sting. Those of us who have come in contact with a jelly-fish when walking barefooted on the beach, or when swimming in the sea, can best imagine how we should feel if one of those long tentacles became entangled round us.

Deep down the sea, awaiting the fisherman's net, are some curious things called sea-cucumbers, which can swallow shell-fish whole, and dissolve their flesh out of the shells by means of certain digestive juices.

These animals are strange things to handle, for if they are frightened they cast off their tentacles and shed all their internal organs, and lie as if dead. They remain in that condition for months, but then new organs begin to appear in the old, seemingly useless case, and all is well again. If we could only do that with a tooth which aches! Not far from the home of the sea-cucumber may be found the basket-fish, one of the most curious of the star-fishes, which seems to have a hundred arms. With these it surrounds its prey, settling down over its victim as a bat settles down in captivity, with its wings outspread over the food which has been given to it.



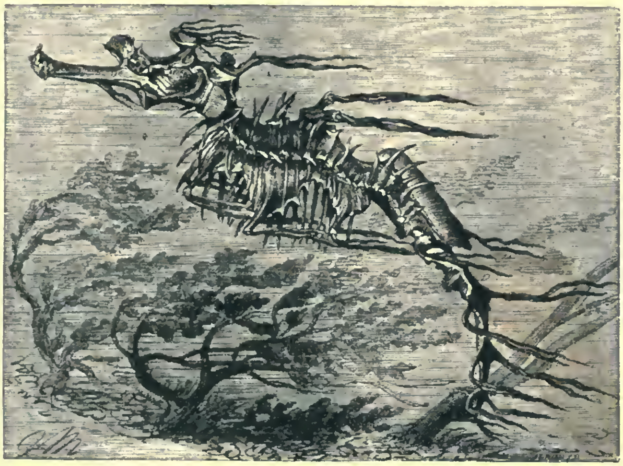
THE GRAVE LITTLE CHAMELEON FEEDS
Six wonderful photographs, by W. P. Dando, showing how this creature darts out its long tongue and seizes its prey.

Our last peep must be at a shore specimen, and this must be taken between tides, when the sea has rolled back its waves from the beach. Our object is to find a shell-binder, and most difficult it is to get one. The animal is a worm of the sea-shore, which, though it excavates so well, is a soft-bodied creature with delicate gills. It has to make a tube down into the sand into which it can fit, moving up or down as it may desire. The worm strengthens the tube by piecing together a number of tiny shells or little fragments of broken shells, and in this tube this strange creature makes its home, so deep down that it is almost impossible to dig out the whole tube, as the shaft is sunk in places where rocks and stones abound.

When its home is attacked the shell-binder slips down to the deepest point, and we may fancy that the laugh is on his side, for, though we use spade and shovel with all our might, it is fairly

THE FRILLED LIZARD READY FOR AN ENEMY

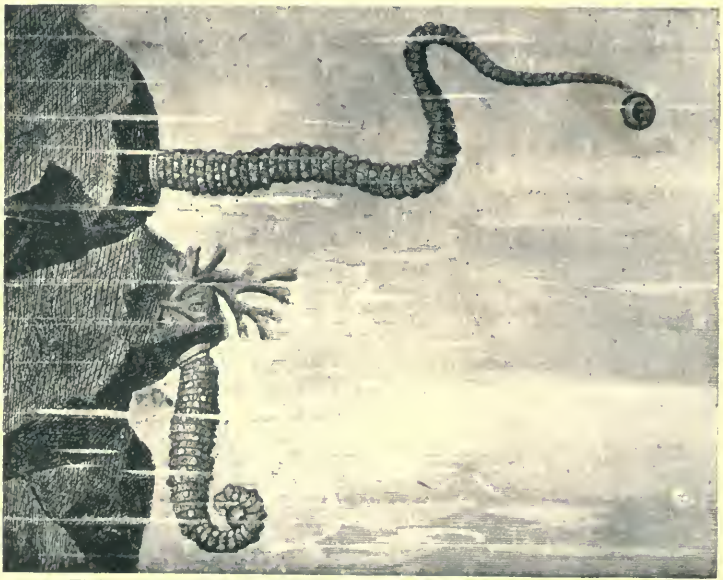
certain that we shall not, in nine cases out of ten, have completed our task before the tide comes swirling in to drive us helter-skelter to the safe side of high-water mark. But if the whole tube with the shell-binder inside can be got, then our museum becomes at once distinguished above those of nearly all our friends.



THE SEA-HORSE LIKE A SEA-WEED

Thus Nature's family amuses and instructs us. We should be unwise to be content merely with a laugh at the curiosities that strike us. There is a purpose and a plan in these curiosities, and by studying them we may get at the secret behind an ugly face or a garish group of colours. Animals that seem ugly to us are beautiful to their own kind; animals that are handsome in our eyes would be hideous to the unlovely kinds. They all strive for excellence in their own way, and those which excel others, whether in beauty among the beautiful kinds, or in what we think ugliness in the ugly kinds, they are the successful ones. The uglier a bulldog is, the greater his "beauty" in the eyes of his master. So it is in Nature. The more terrible the little frilled lizard can make himself appear, the more likely he is to be unmolested, and the more certain, therefore, to live to a green old age and leave a family resembling him. The less terrible-looking ones might be snapped up young. The spider-monkey with the most spidery legs, and longest, most flexible, grasping tail, will be the best climber and obtain the finest food; hence he will be the strongest and most fitted to survive. The saw-fish which combines most intelligence with the fiercest saw will thrive more than his sluggish brethren.

There is a reason for everything in Nature, and where we set out to laugh we stay to wonder and ponder, and finally to admire.



THE LONG SPIDERY ROCK-LEECHES LOOKING FOR FOOD

THE JUNGLE AT YOUR DOOR

ONE OF THE MOST ASTONISHING SERIES OF PHOTOGRAPHS THAT HAS EVER BEEN TAKEN

CREATURES THAT CREEP AND CRAWL ABOUT THE HOUSE IN MANY COUNTRIES

We move about our homes, and walk about our gardens, and cross our back yards, and lie down on our lawns in summer, little thinking of the teeming life that goes on there ; yet all these places are a busy world to countless living things. Let us put on the eyes of a microscope and see our neighbours as they are.

BEETLES and caterpillars and spiders and flies are to us simply so many creeping, crawling, or flying things of very little account. But to the weak, harmless little insects what a world of terrors this is ! They see the mysteries of the animal life around them. They see the awful jaws with which an ant or a beetle is armed, the deadly poisoned jaws of the spider, the murderous spear of the wasp or the bee, the all-embracing legs and mighty jaws of the dragon-fly.

We sit comfortably at home, or romp in the garden, heedless of what is around us, though if we could see as insects see we should realise that we have a veritable jungle about us, at our very doors. If some goblin should make us for a day as tiny as Alice became in Wonderland, we should feel that we had been cast back into the days when the giant reptiles inhabited the earth. Depend upon it, a caterpillar of today finds the devil's coach-horse just as awful a creature as the herb-eating monsters of old time found the huge flesh-eaters. Let us pretend for a while that we are small, and that the insects appear to us as they actually look to other insects. The camera will help us.

We are surrounded by dragons dire and terrible to the smaller world. Some of them compete with us for life, some of them have got into our homes; others are always threatening to invade us, as the snakes and lizards invade the homes of our cousins in the tropics. Some, like that hungry cannibal, the cricket, or the hateful cockroach, are as securely established in the house as we are ourselves. Some, like the ants and the spiders, come upon us like the tigers and leopards which descend upon the homes of man in Asia. If our eyes were microscopic in power, like those of the insects, these invaders would appear as terrible as lions and tigers.

What a fearsome creature the cricket must look to other insects ! At first sight the head may not appear very alarming, for there is seemingly no mouth. But suddenly the horrid face seems to open, and the front part of the face is raised. The cricket wears a mask. A horny flap rises, turning upon a hinge, and a terrible mouth appears. There are two pairs of jaws, one pair horny and toothed, the second pair with very sharp teeth to each jaw. That is what the mask conceals. There is no question as to the usefulness of the teeth, for the cricket, as we all know, bores tunnels into the cement around the fireplace or any other brickwork which leads to warm quarters. A fearful death-trap to smaller insects that mouth must be. Those horny toothed jaws, which can excavate in solid mortar, easily nip an insect in two ; and, as crickets eat other crickets, we may take it that they eat other insects as well.

When cricket battles with cricket what a conflict it must seem to, let us say, the earwig, when it strays into the house ! The crickets, with their great jaws, their monstrous leaping legs, their battle cries and shrill love songs—truly they seem to reproduce, on a smaller scale, those monsters of the old, old days before men were yet upon the earth. As to the leaping power of the cricket, it is such that, had a man such power, he would be able to leap over the Capitol at Washington at a bound. The battle song or love ditty of the cricket comes only from the male, and is produced by rubbing one horny wing against the file-like prominences of the other—for these little monsters have two pairs of wings, and can fly, though we rarely see them do so.

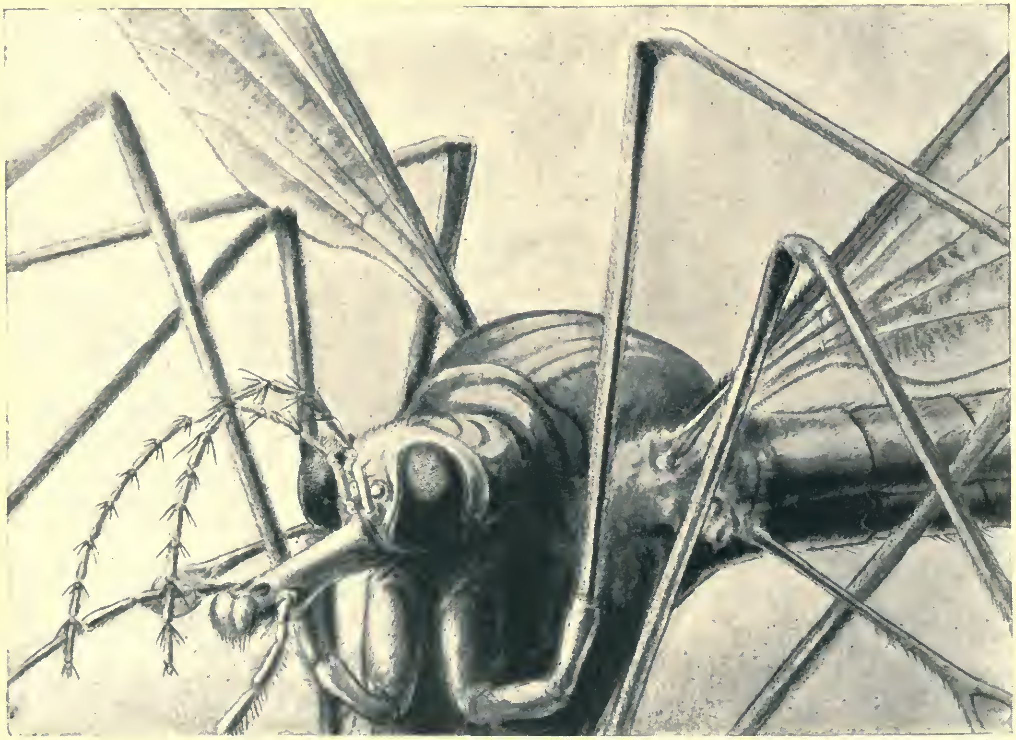
There is another flier in the house that we hardly ever see upon the wing, and that is the cockroach, but here only the males have wings. The appearance of the cockroach must be terrifying to smaller neighbours, for these insects have powerful armed jaws with which they can eat anything. They can tunnel a cheese or a potato. They will nibble boots and the leather binding of books. There is nothing they will not eat that can be gnawed, and a cockroach will eat a cockroach with the greatest pleasure.

In picturing a jungle at our doors we must extend the fancy to our own apartments, for the cockroach is as securely lodged in the house as the mouse, and, as long as fire and food exist, cannot by any ordinary means be exterminated. He is as much an inhabitant of our homes, indeed, as we are ourselves.

But let us step over the threshold, and there we find our jungle on a small scale, without pretence. Garden and field teem with insects, and we may divide them all into two classes—those feeding upon vegetation, and those feeding upon other insects. Of course, the idea is terrible, but the insects that eat other insects are really our guardians; those feeding upon vegetable matter, unless it be waste matter, are our enemies, taking the food from our mouths or robbing us of the glories of our flowers. There is one big family of beetles which, from their ferocious habits, we call tiger beetles. They are all rather long in the body, with hard coats of mail, shining with metallic lustre, big, prominent eyes, ever on the look-out for living prey, upon which they advance with swift, darting steps; while they themselves, if alarmed, can seek safety in flight.

The green tiger is to be found almost everywhere in America. Let us close our eyes to his methods of gaining a living, and be thankful that, terror as he must be to smaller insects, and even to larger kinds which cannot fight him, he is here for our protection. Our gardens would be less beautiful without him; our heaths would be less glorious in summer; our pine woods less noble; our fields and pastures less fruitful for cattle and sheep and horses.

If the little, creeping things miss the tiger beetle's jaws, there are several families awaiting them belonging to what we know as the carnivorous ground beetles. They are many, not only in number but in species;

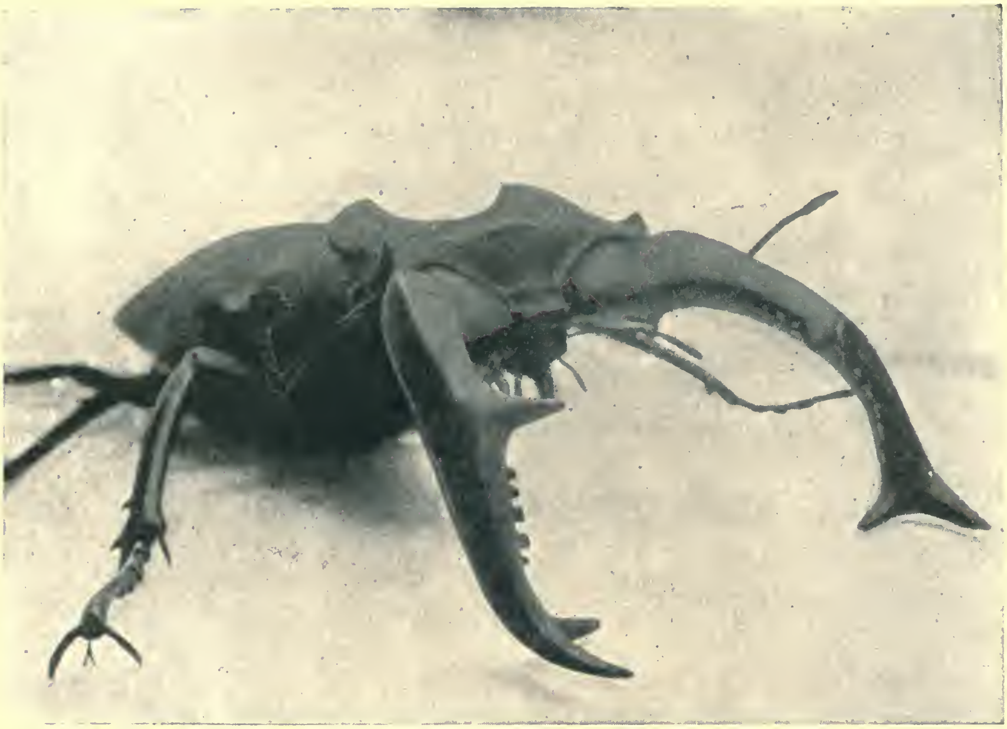


The Crane-fly. This fierce looking insect is commonly called daddy-long-legs. The beak cannot bite, but only sucks up juices. The offspring of daddy-long-legs are the terrible leather-jackets, which live in the soil and do enormous damage to vegetation.

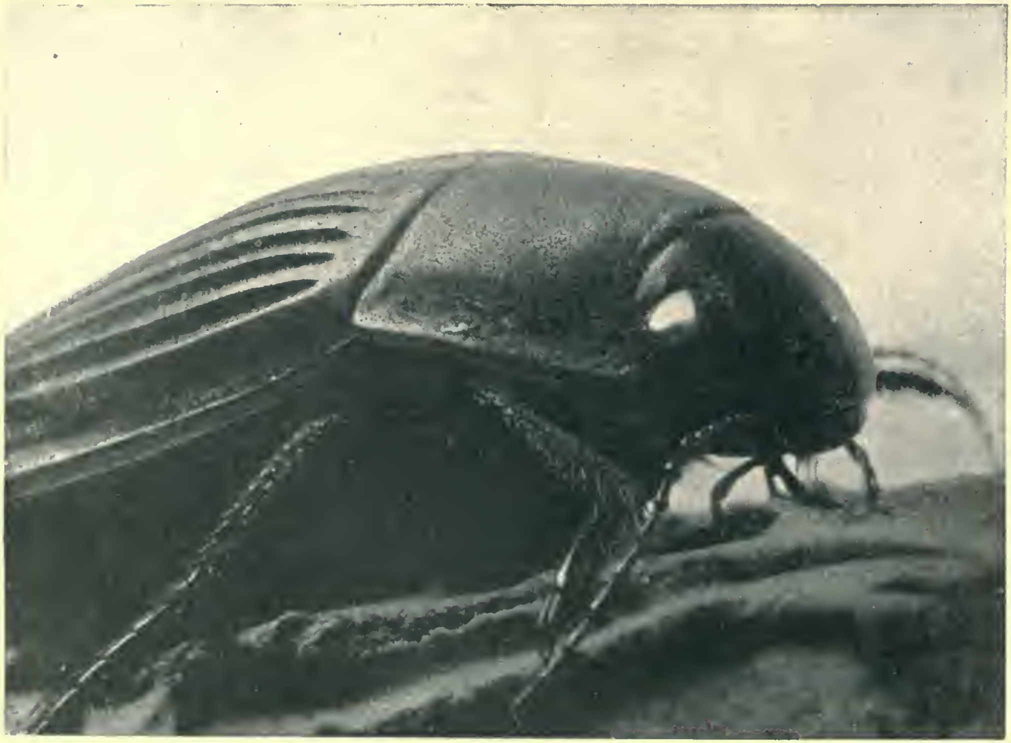
THE EARWIG COMES TO DINNER

The Earwig is not known in America, but is a familiar insect in Europe, where it invades houses and does much damage to flowers in gardens.

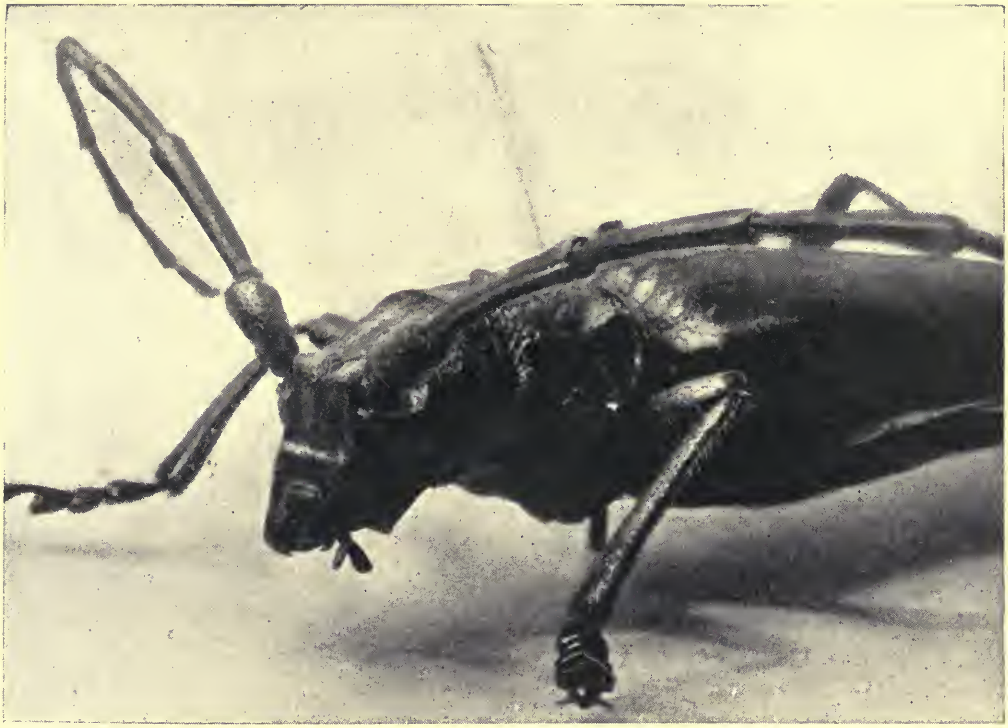
GIANTS THAT LIVE IN WOOD AND WATER



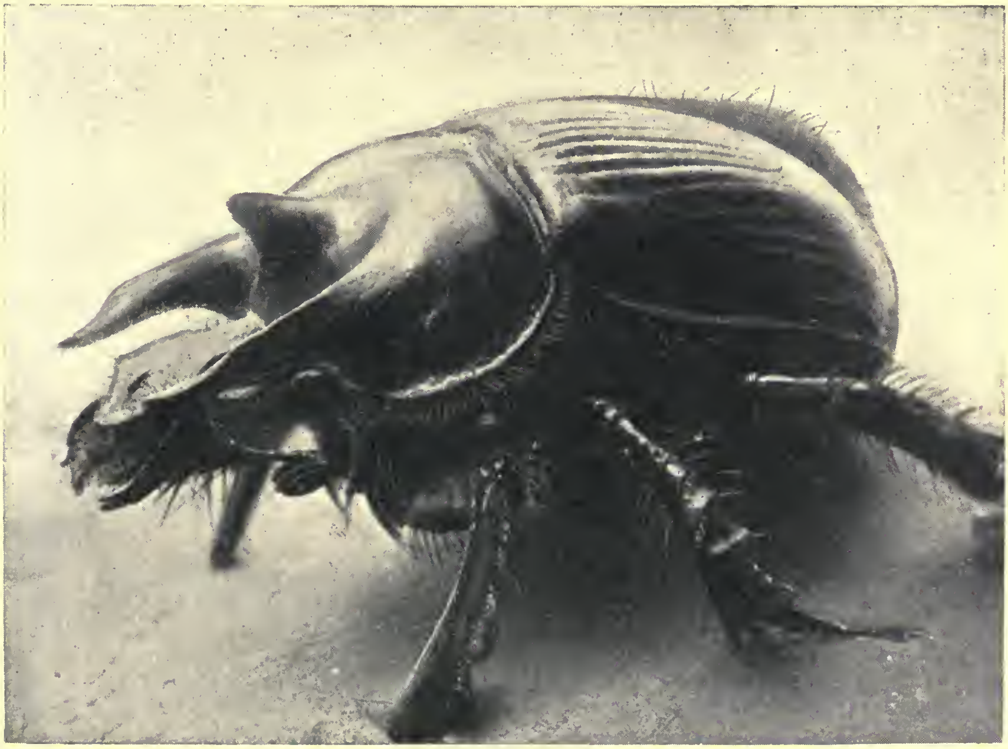
The Stag Beetle. One of the largest of all beetles, the stag beetle has "horns" like those of a stag, but notched, like those of a lobster, to enable it to grapple an enemy. The young live in the wood of trees, and take five years to grow up.



The Water Beetle. Born in pond or ditch, our great water beetle goes to land for its chrysalis stage, and then returns to the water, where it eats anything, from water snails to little tadpoles and baby fishes.



The Musk Beetle. Where bushes and trees, especially willow-trees, are decaying, we may expect to see a shiny beetle, decked in tints of blue and coppery green. It is the musk beetle, so called because the odour it gives off is like that of musk.



The Typheus Beetle. Clad in heavy mail, and armed with three horns, the typheus beetle is a fine scavenger. Its eggs are laid in the refuse of the fields, where the young and their parents make pastures wholesome and land more fertile.

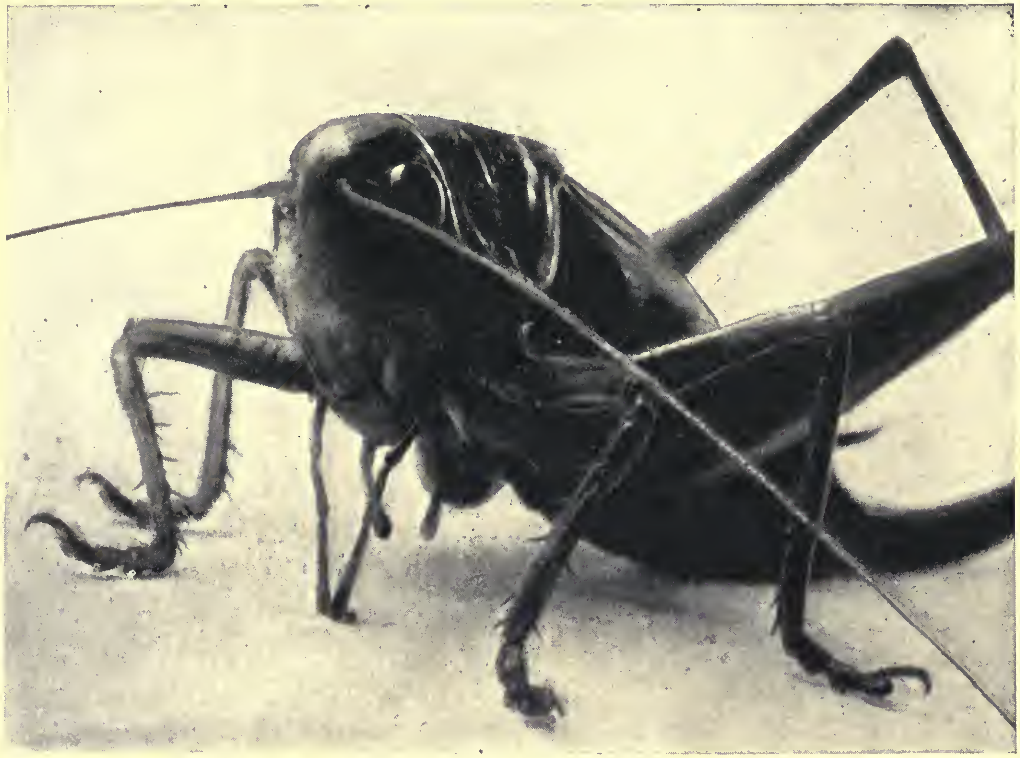
there are seventy species in the British Isles alone, so that an injurious insect, if he dodges the jaws of the tiger, may make a meal under a stone, or among the moss, or upon the trunk of an oak or fruit tree, for a handsome coppery bluish inquisitor. Not all the carnivorous beetles are copper-coloured, of course ; we find all sorts of metallic hues among them, but many of them are black, matching their dark surroundings, for they lurk in secret places, to gobble, gobble, gobble up the enemies of mankind.

A thoughtful insect, if he stays to ponder the perils that he runs from tiger and carnivorous ground beetles, may decide to change his quarters, and the result may be that if he escapes the tiger he meets something far worse in our sable friend, the devil's coach-horse. This is one of a numerous family of rove beetles, and is the fierce-looking fellow which, when we arrest its progress along the ground, places itself in a position of defiance, with tail turned up and its massive jaws wide agape, ready for instant battle. These jaws, which look so threatening, are really masterpieces of the lower world. How awful they must seem to a caterpillar, for the rove beetle can cut one of these insects in halves at a single bite, and they are equally effective against more formidable foes. One good naturalist has a sort of alliance with the devil's coach-horses, keeping one in his cellar, where, in exchange for his hospitality, as it were, it devours the cockroaches that go down to rob his larder. To a cockroach the rove beetle, with his immense jaws, must seem a frightful monster, as terrifying as the giants from which the crocodiles descend.

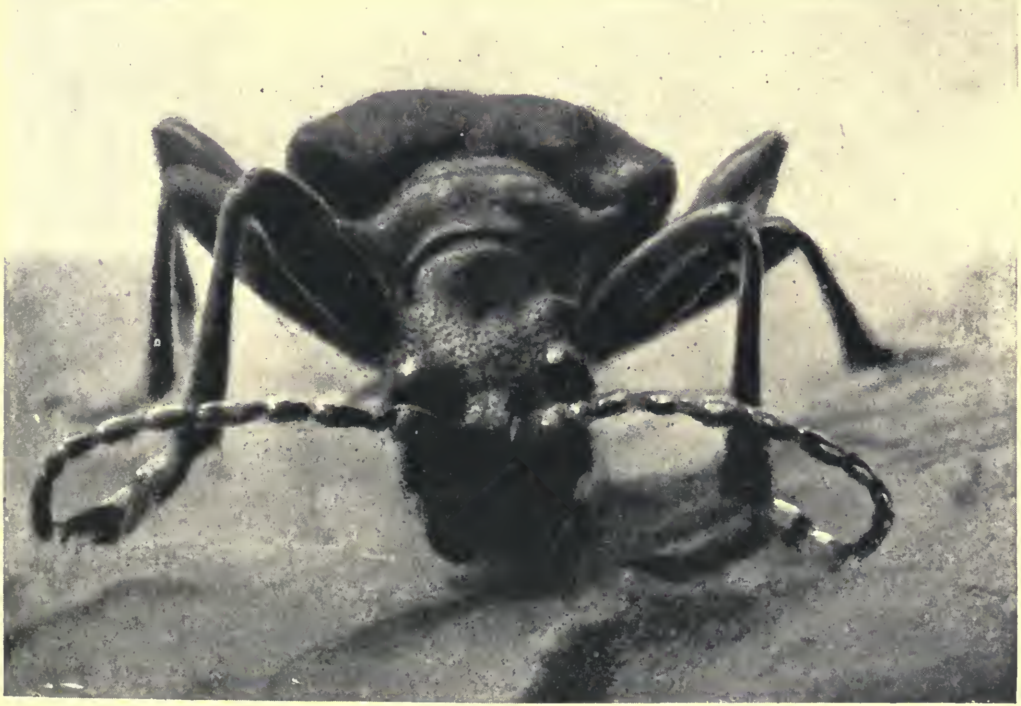
Finding fierce foes so many on the land, our reflective insect may wonder whether life in the water would not be safer, yet there we find some of the fiercest members of the insect world in the great water beetles, equally fatal to insects, worms, snails, baby fishes, and little tadpoles. Our trembling fugitive finds himself face to face with a creature resembling the sort of caterpillar that insects in a nightmare might dream of. It is really the larva of the great water beetle, and has a long, tubular body, with six legs fringed with hairs, so that they act as oars to row the creature along, while two hooked claws give it power to climb or to grip our little wanderer. What jaws of wonder and terror it has! Their mystery is all plain to our insect, but the great naturalists of Europe quarrelled for years most angrily over the matter. We know at last what that wonderful mouth is. It consists of a pair of powerful pincers, curved like sickles, and through each runs a tube, back into the creature's throat. With these tubes it sucks its victim's blood, while the mouth opens to allow it to swallow solids. It is strange to think of insects with hollow fangs. Until not long ago men thought the hollow fang belonged to the poisonous snake alone. This is the principle upon which the spider's armament is fashioned. Although to the unaided eye of human beings the mouth parts of the spider are a mystery, other insects know what is there. They must know that through the terrible fang of the mistress of the silken web runs

A BATTLE OF GIANTS TWO STAG BEETLES FIGHTING A DUEL, PROBABLY ABOUT A LADY OF THEIR KIND

THE WONDERFUL JUMPER & THE CLEVER BORER



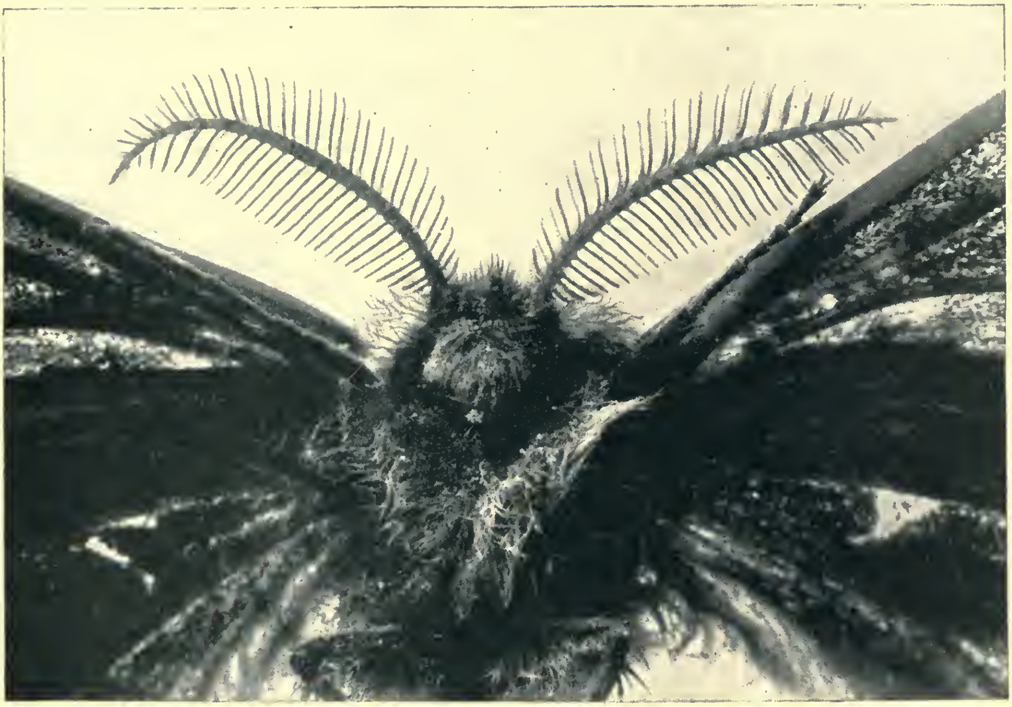
The Grasshopper. We know him by his "song" in the grass, and suspect him as a kinsman of the locust. But he is a friend. He leaps upon caterpillars and other insects and eats them, and so helps to protect our food supply.



A Timber Beetle. He is an expert wood-borer and an enemy, a black-coated artisan splashed with yellow. The larvæ tunnel in pine-trees, and eat the wood through which they burrow, leaving open avenues in the trunk for fungus and disease.

a poison duct, through which venom is forced as she makes her bite. What must a spider look like to its victim? Its foot, which marches with marvellous rapidity up and down the spars of the web, has instead of toes three sickle-like claws, and a comb attached to each. And the silk-spinning apparatus, which weaves a web that can withstand strong winds, will bind the spider's victim in chains of silk from which there is no escape.

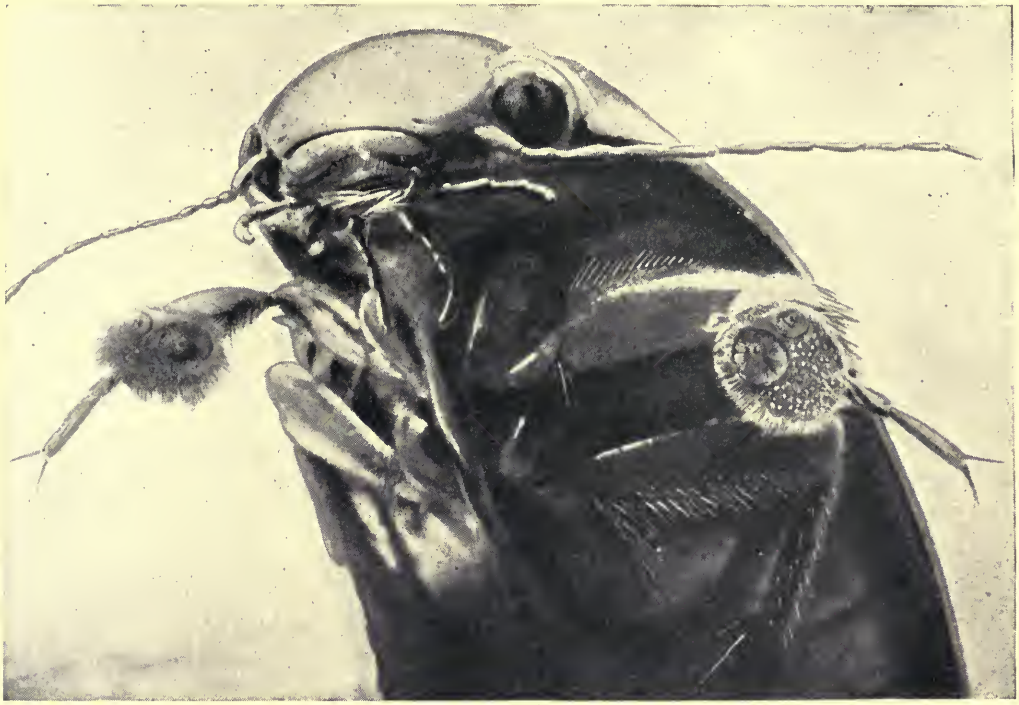
Nothing that man has to fear is relatively so much to be dreaded as the spider must be by the fly. The spider combines the poison fangs of the cobra with the enfolding grip of the python or the octopus. Life would be like a horrible dream if our eyes could see this animal in all its terrible perfection. Yet, let us remember, it is not an enemy to us; it is a friend of enormous value, although cleanliness compels us to sweep away the webs made by those spiders that brave the terrors of man, and boldly take possession of his home.



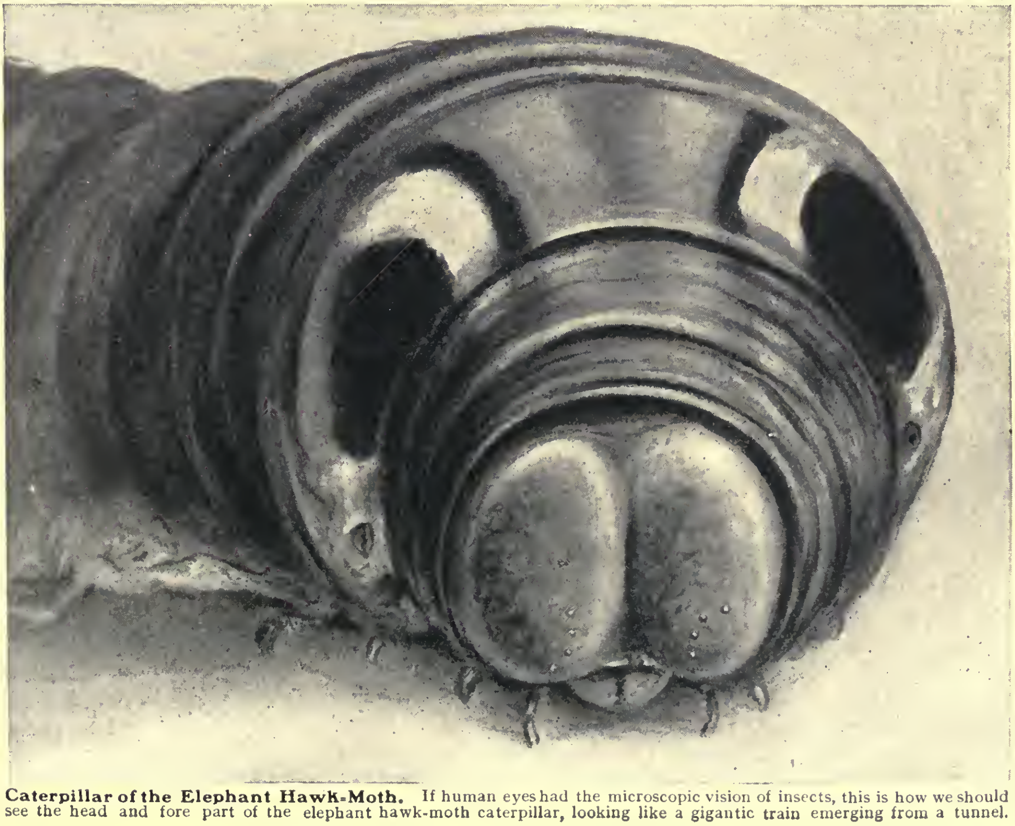
The Emperor Moth. This photograph does not represent a vampire bat, but shows us how, in the eyes of an insect, the under-side of the handsome emperor moth really looks as the insect flits over the heather or in the neighbourhood of woods.

But let us leave the webs and waters and their wonders, and turn to the open again, to peep afresh at some of the tiny monsters of our jungle. Let us consider for a moment the longicorn beetles, whose strange, long antennæ, or feelers, curl backwards along the sides and often exceed the length of the body. There are some very handsome specimens in this family, and some giants, too. One longicorn, from Brazil, is six inches long. Great Britain has rather a famous example, a longish beetle, gay with shades of green and copper and blue, and known as the musk beetle, from the fact that it emits a strong odour of musk. This scent-giving power of the denizens of our little jungle reminds us afresh of the jungle proper. Among the big animals are many, such as certain deer, civets, skunks, and so on, which give off powerful odours. So do beetles in many instances, and the devil's coach-horse and the ladybird; and one beetle puffs out a fluid with such force that the operation can be heard in a series of little explosions, so that we call this creature the bombardier beetle. Other beetles have a fluid which blisters the flesh. The longicorn beetles are often our enemies—generally, in fact. They live in trees, tunnelling into the bark, and so preparing the way for fungus and disease. Clever men say that we owe rubber to beetles of this type, that trees had to produce a bitter, stinging sap which would kill intruding beetles, and at the same time seal up the wounds caused by the enemy's sharp jaws. Men now

THE FEARFUL THINGS SMALL INSECTS SEE

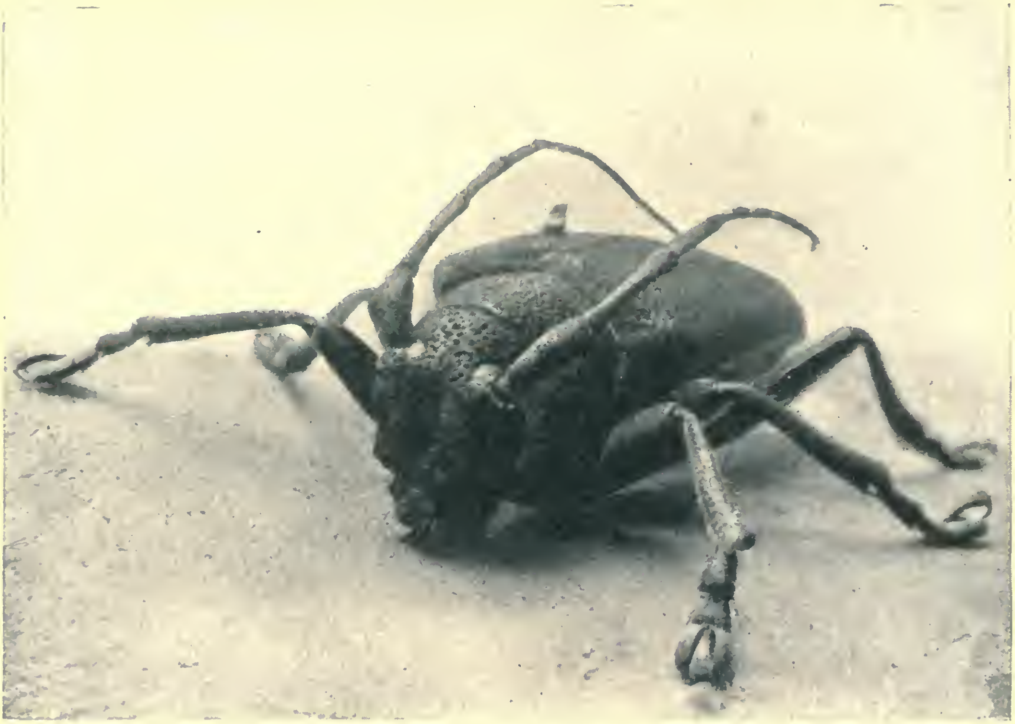


A Male Water Beetle. Here we see the sucker-pads on the fore-legs. Each pad can support 13 times the weight of the beetle. Their gripping power is aided by sucking hairs, of which there are 170 on each fore leg, and 160 on each middle leg.

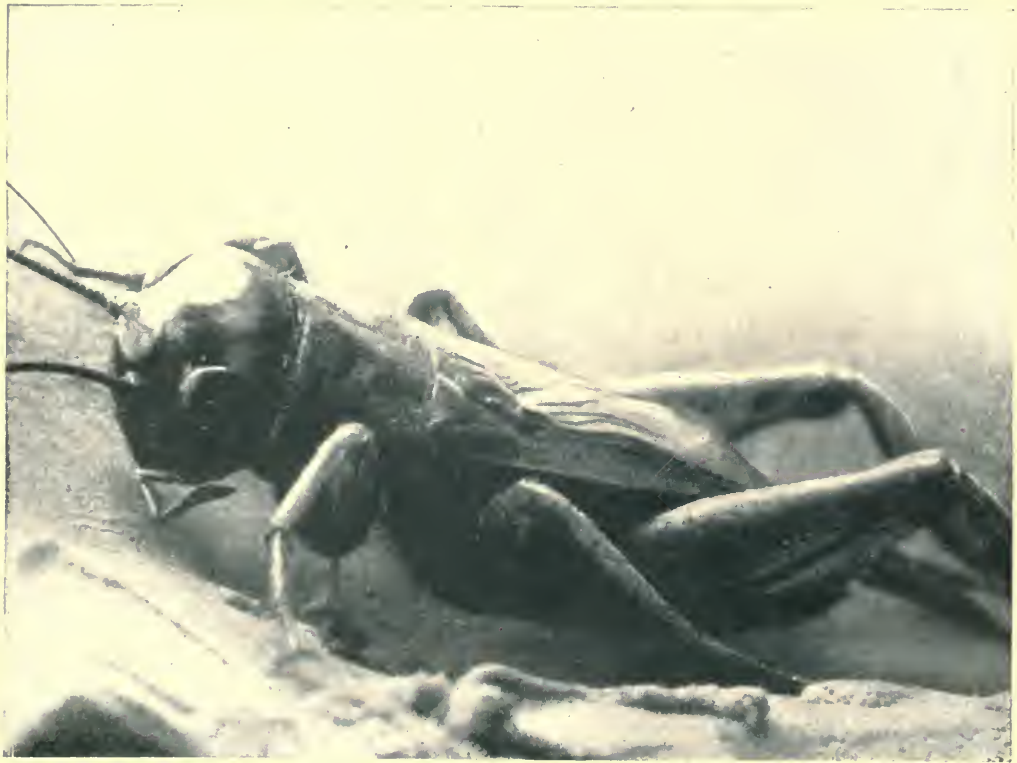


Caterpillar of the Elephant Hawk-Moth. If human eyes had the microscopic vision of insects, this is how we should see the head and fore part of the elephant hawk-moth caterpillar, looking like a gigantic train emerging from a tunnel.

THE CANNIBAL CREEPING IN THE BACK YARD

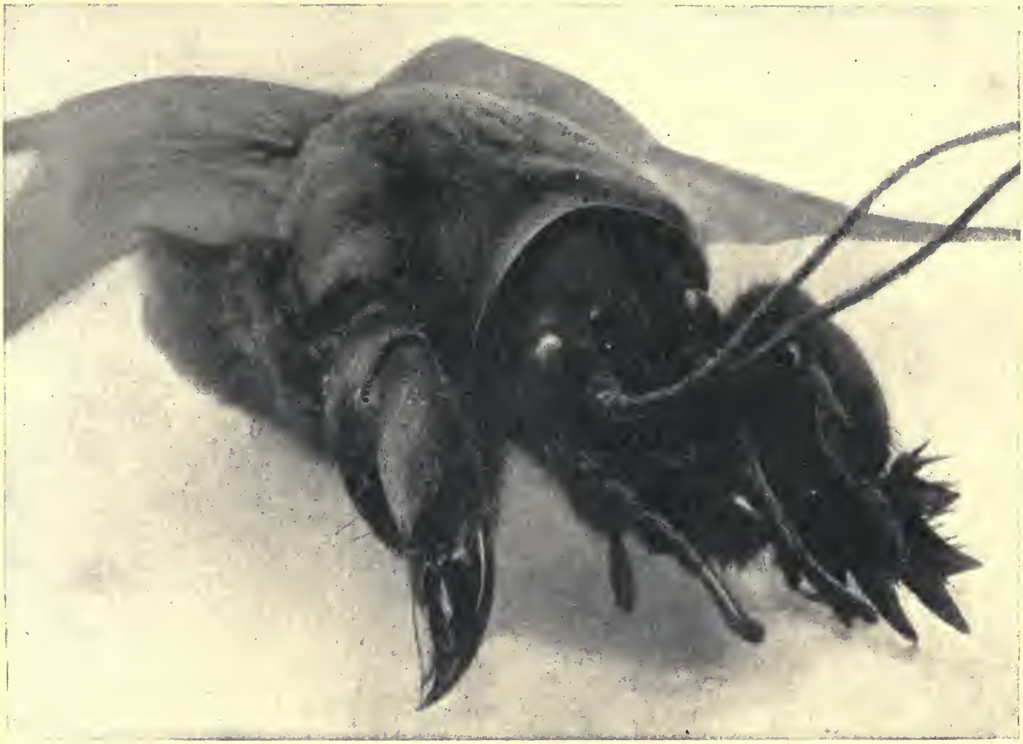


A Longicorn Beetle. These beetles are so named by joining Latin and Greek words which mean long-horned. This one eats growing poplars and willows, but, for all its alarming appearance, it would not hurt us, though it takes our timber.

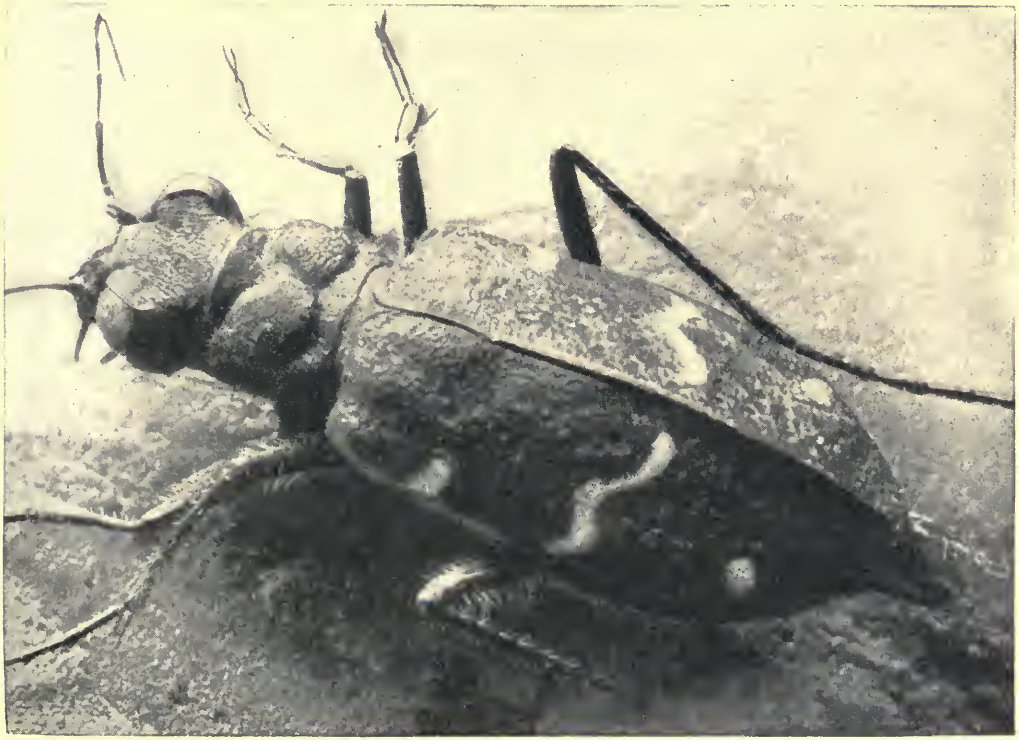


The Common Cricket. Poets have given the cricket an undeserved character for good nature. In reality he is quarrelsome and a cannibal. The cricket has very strong wings. To equal a cricket's jump a man would have to leap 600 feet.

DESTROYER OF GARDENS & FRIEND OF WOODS



The Mole Cricket. We see the resemblance between the fore legs of this cricket and those of a mole. The insect is a fine engineer, but does harm by tunnelling through roots of flowers, and is at times a serious plague.



A Tiger Beetle. This wood tiger beetle is a friend to tree-lovers, for it lives principally in pine woods, devouring insects which would harm trees. Hence we may imagine the pleasing truth that the beauty of pine-woods is owing to these beetles.

convert this sap into the rubber that carries bicycles and motor-cars.

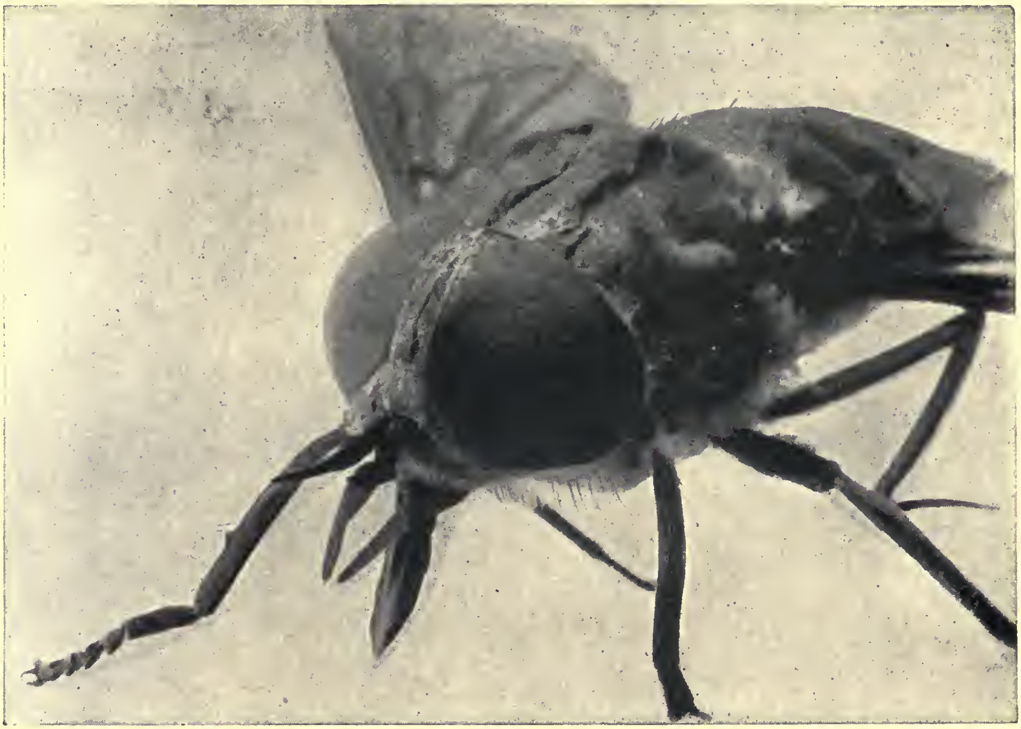
Of course, the longicorns are not the only tree burglars; the weevils are among the worst. There is one weevil more destructive to young pine plantations than perhaps any other insect. They are all singular-looking insects. Most of them have snouts. The head grows out into a long, slender snout suggesting a tiny edition of the elephant's trunk, but the mouth is at the tip of the snout. And when we crack a hazel nut, and find the interior reduced to a sour, dark powder, we know that a nut weevil has spent the summer there. This nut weevil is perhaps one of the strangest-looking insects we have. The head, behind the eyes, seems absurdly short, but the beak is immense. All beetles have antennæ, but the nut weevil, having so short a head and so long a snout, has apparently had some difficulty in finding a position for them. So its antennæ, or feelers, grow out from the sides of the snout, half-way between the eyes and the mouth. When the hazel nut is soft and young, the mother weevil makes a hole in the tender, fleshy shell, lays an egg, and with its long beak thrusts that egg deep into the interior of the nut. When the baby weevil is hatched, it feeds upon the growing kernel until the autumn, when it is ready to emerge. Then it tunnels a little hole through the shell of the nut, crawls out, drops down into the soil to pass the winter, leaving a ruined nut behind, for which some disappointed man will pay at the rate of eighteen to twenty cents a pound. But if the buyer could have a peep at the extraordinary creature which did the damage, he would feel compensated for the loss.

Another dweller in the tree-trunks is the stag beetle, which we certainly should not believe in if we did not actually see it. The largest of all British beetles, armed with jaws resembling the antlers of stags, the stag beetle, even in this jungle of small things, reaches a length of three inches, and must be considered a frightful creature. But, like many of the old-time monsters, it is purely a vegetable feeder. Its massive framework has been built up on a great diet of decaying or even sound wood, eaten in the heart of some tree-trunk. It has taken the young beetle five years to complete all the changes which bring it from the larval to the perfect stage. When we see a small stag beetle, we may judge that it has passed its life amid scanty food supplies, or where the quality has not been rich enough to nourish the grub properly.

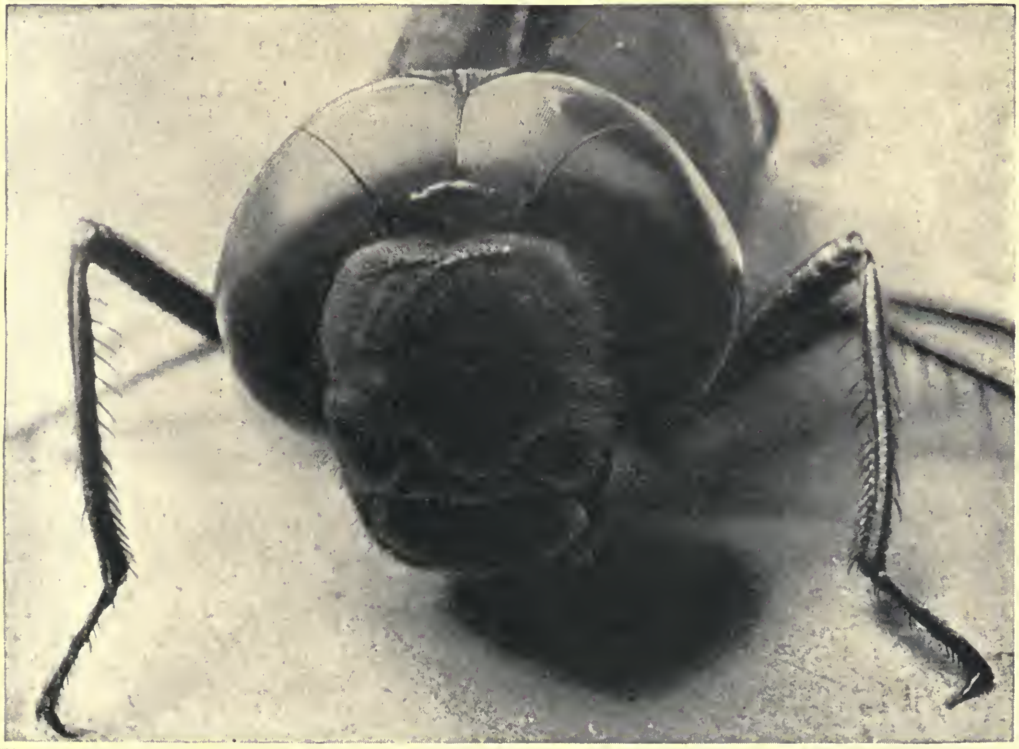
A Dragon-fly's Larva. This frightful-looking creature might well pass for a six-legged toad, if such things existed. The great eyes suggest the marvellous organs of the perfect insect. These larvæ are dragons indeed to other water insects.

Diet should in some way reflect itself, one would think, in the character of the insect that eats it; but it does not. Some of the handsomest insects eat the most unpleasant food; others, feeding on dainty supplies which should appeal to a poet, are great, burly, bullying things, swaggering about in lovely metallic hues, but so stupid and clumsy, falling here, butting there, crashing

FLIES AS DEADLY AS ARMIES & FAST AS TRAINS



The Gad-fly. This insect, known as the horse-fly, is one of the greatest pests in the country. It plants its eggs in the hides of living cattle, causing damage estimated at $40,000,000 yearly—enough to pay half the Old Age Pensions of the British Isles.



The Dragon-fly. Here we see the head, with the great all-seeing eyes, of the dragon-fly. It is the finest of all our winged expresses, catching insects and eating them as it flies by at sixty miles an hour. What powerful gripping fore legs it has!

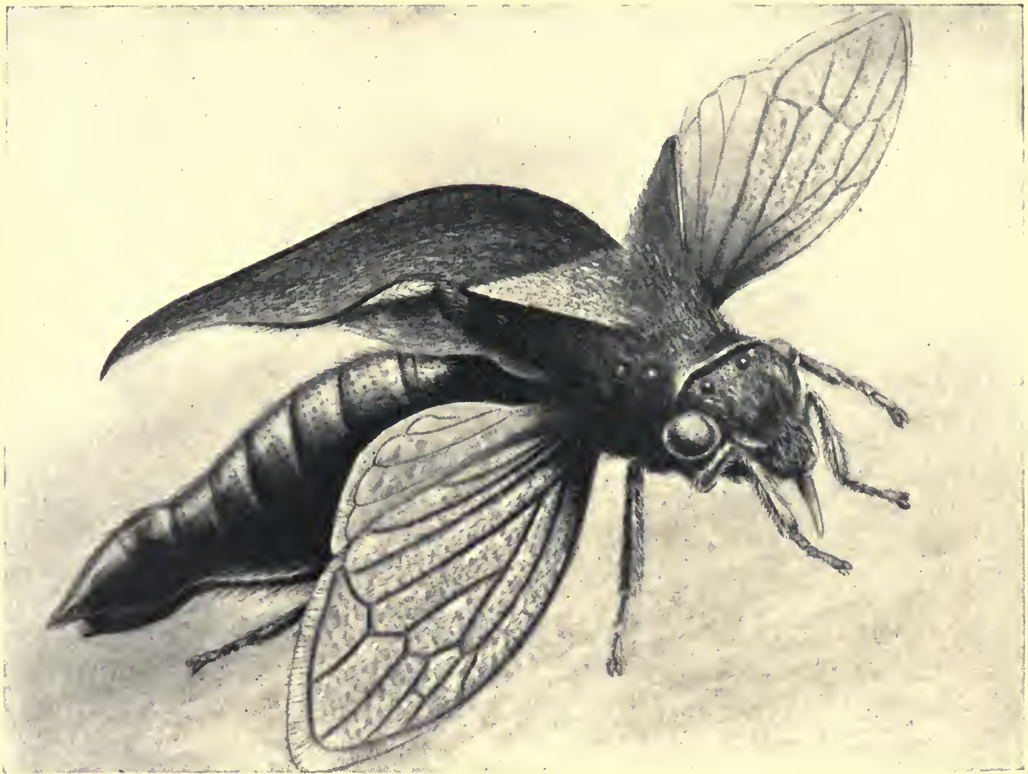
into every obstacle that lies in their line, that we can only think of them as something like elephants in a china shop. The rose-chafer is a swaggering deceiver, with his shining coat of mail, his great size, and his blustering ways. And he is a nuisance for whom no apology can be made, damaging the fairest of flowers and frightening young people out of their wits by his formidable appearance. Daddy-long-legs is another deceiver. With long, feeble legs and flimsy wings it suggests helplessness, until we notice a spear-like apparatus at the rear of its long body. "Ah," we say, "that is one of the stinging sort." Daddy-long-legs does not sting. What we mistake for a sting is simply the drill the female uses for depositing her eggs. With this she bores a hole in the ground in which to cradle the egg. She makes hundreds of such holes, depositing one egg in each. From the egg comes that terrible enemy of the farmer, the leather-jacket, which eats away the roots of the grain that should feed us, and destroys the pasture that should feed our cattle and horses. Daddy-long-legs himself is harmless; his children are a brood of insect imps.

There is a deceiver of another sort among the gad-flies. Here we have insects which might pass for innocent bees, but they are monsters of ill-doing. One species, the ox-warble, thrusts its eggs into the hides of cattle, and the larvæ live in the flesh of the victims. It is a sad and unpleasant story, and we will not go into it here, merely carrying in our minds the astonishing fact that these gad-flies, which attack cattle, make the country poorer by many millions of dollars a year; damaging the milk of cows, which injure themselves in racing about in terror to avoid the fly, damaging meat, and damaging the hide which should become leather. We marvel when we hear of the havoc worked by insects among cattle in Africa, but here is a fly which defeats all our attempts to exterminate it, and does damage every year which, if saved, would suffice to pension half the old people in the country.

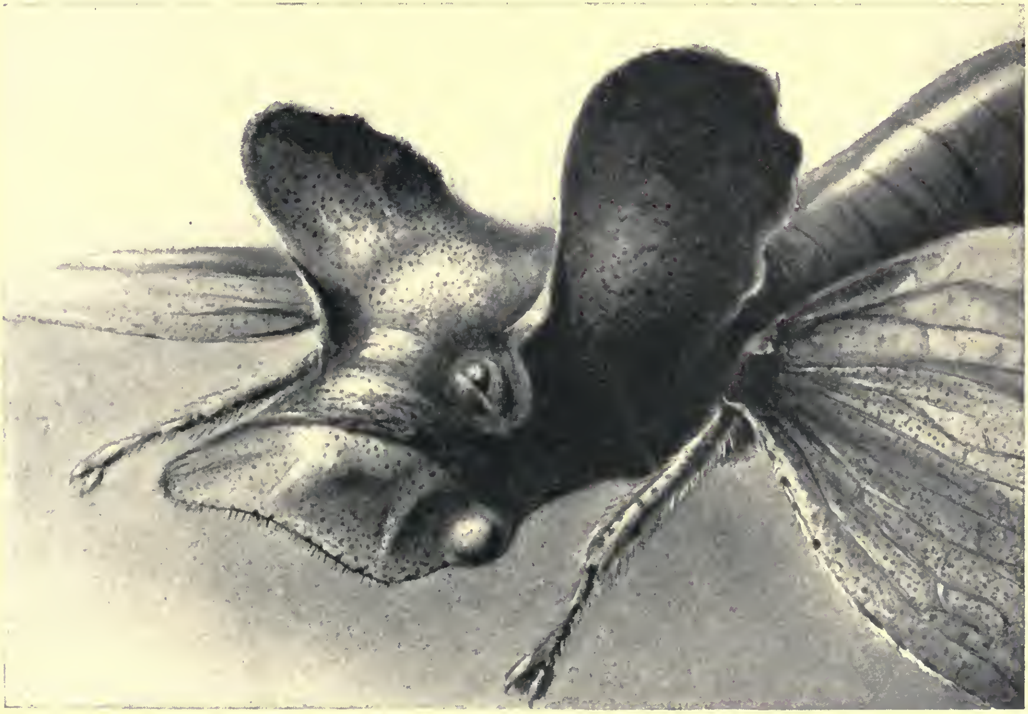
A Rove Beetle. The devil's coach-horse is one of the best allies of the gardener, for it lives mainly on injurious insects. Strong on the wing and fleet on land, it has a special liking for caterpillars, which work havoc with our plants and shrubs.

Most of the insects that we have been considering are good fliers, like the crickets, the male cockroaches, and the earwigs, but we come now to a king of them all, the monarch of insect airmen, the dragon-fly. Our eyes reveal to us only his glorious beauty, his matchless flight, but somebody in the far past, when all the creatures were

TWO TRAVELLERS IN THE COUNTRY LANES

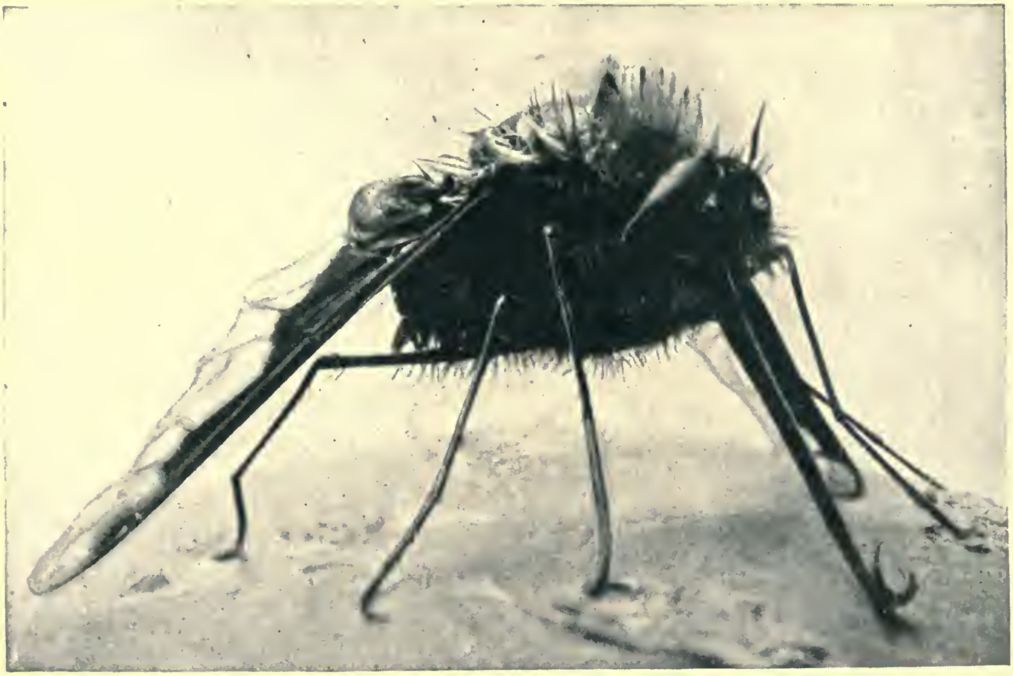


A Spined Monster. All the insects of this family are distinguished by their extraordinary appearance. They are mainly tropical insects, and this is one of the few species known to live in the north. It is armed with spines.

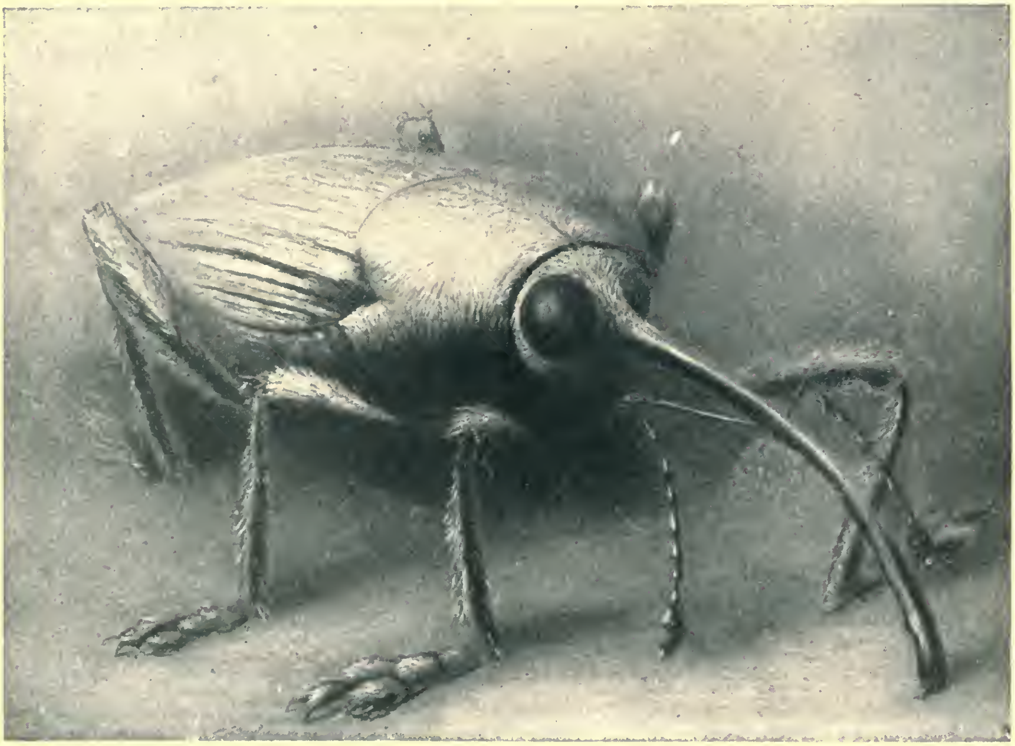


A Sort of Frog-hopper. This is one of the strange insects belonging to the frog-hopper, or cuckoo-spit, family, small creatures which feed on the juices of plants and cradle their young in froth. Note the curious things like ears at the back of the head.

THE MONSTER BORN IN A HAZEL NUT

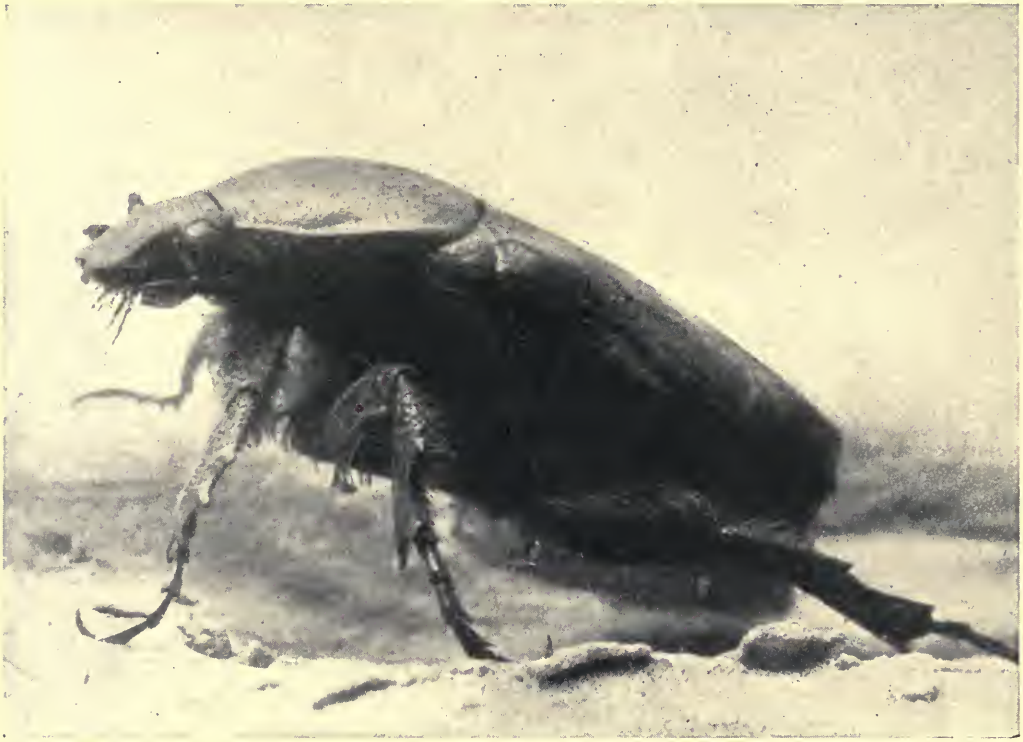


The Bumble-bee Fly. We see here an unusual attitude of the bumble-bee fly; generally we note it hanging almost motionless in mid-air, thrusting its proboscis deep into a flower and drinking the nectar. The larvæ eat caterpillars and other grubs.

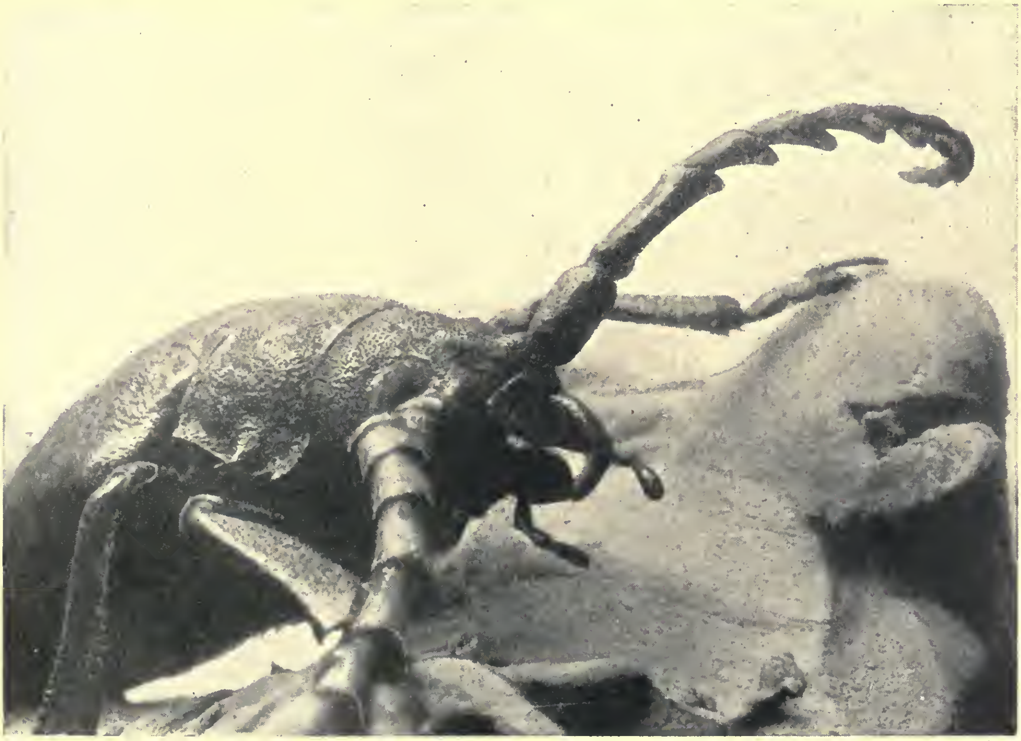


The Nut Weevil. The bumble-bee fly eats in the open sunshine, but this weevil feeds in the dark recesses of a hazel nut. The long proboscis serves to push the egg through a hole in the shell of the young nut, which is the larva's cradle and larder.

THE GIANT WHOSE LIFE IS ROSES ALL THE WAY

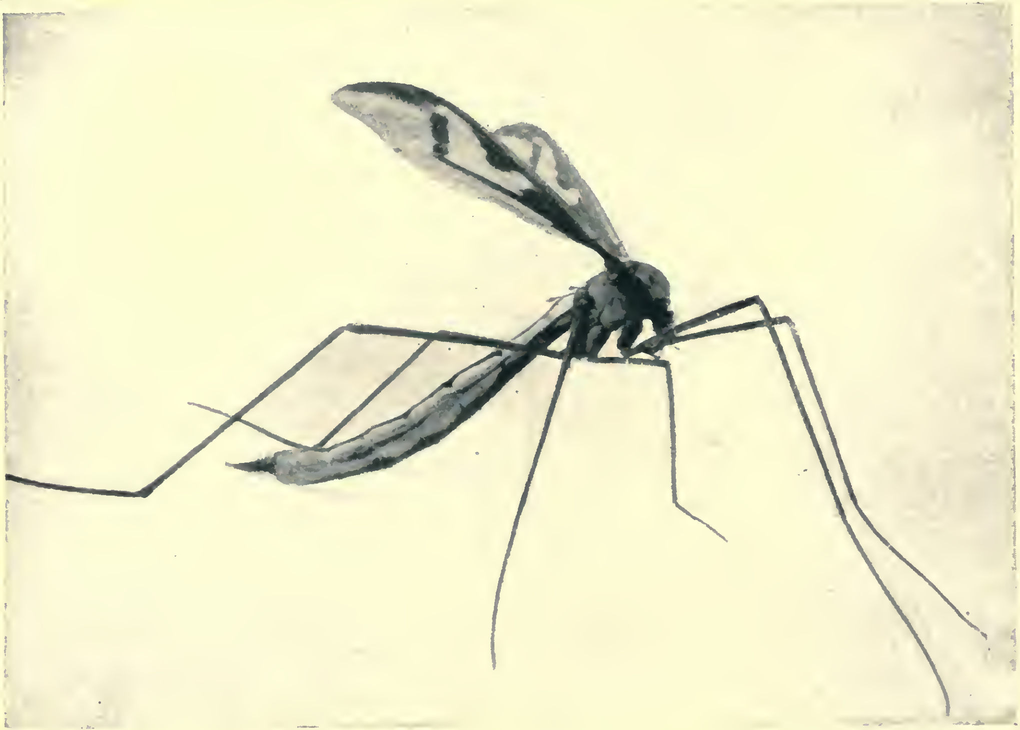


The Rose-chafer. This big, blundering beetle lives on our roses. Habit and example should make it more agile than it is, for, while the larvæ are often found in rotting wood, they are sometimes cradled in that home of wisdom, the ants' nest.

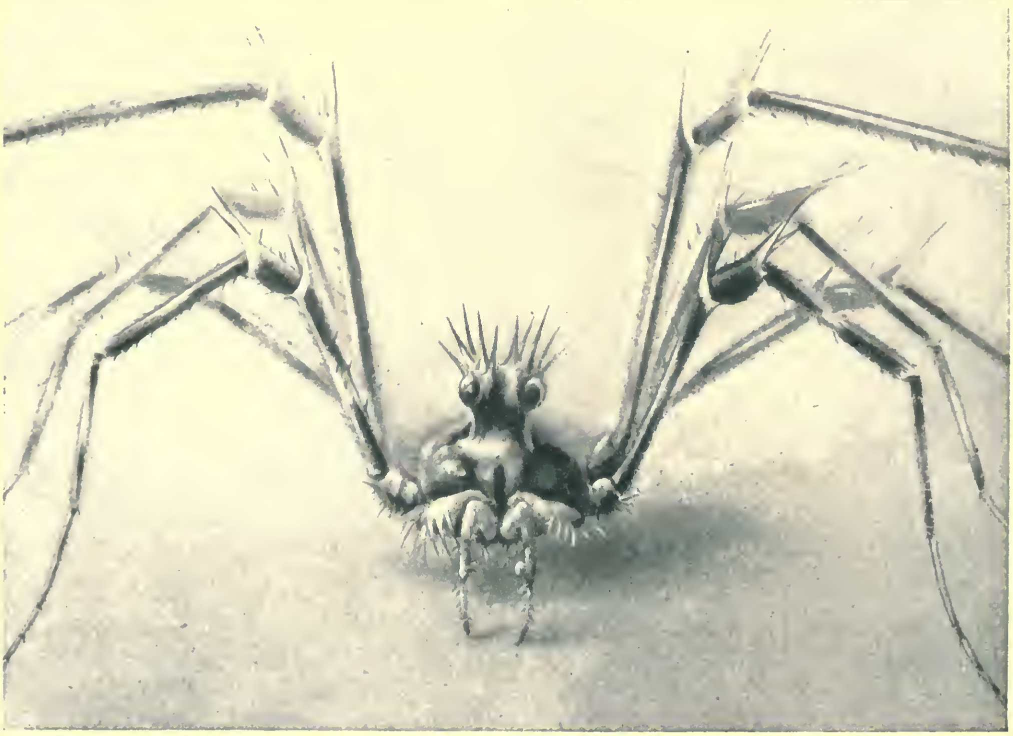


A Longicorn Beetle. A tremendous picture to an insect's eye is this beetle, which, like most of these long-horned beetles, lives on the blooms of plants and on wood. Other insects have nothing to fear from them, however, formidable as they seem.

DADDY-LONG-LEGS AND LITTLE TOMMY NODDY



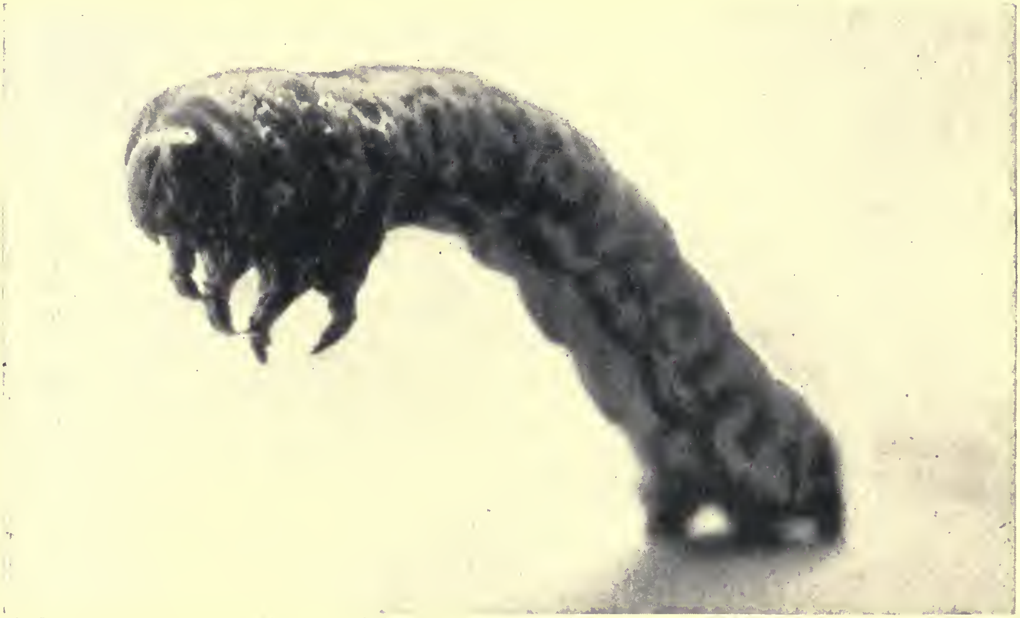
Mother of Daddy-Long-Legs. The mother of the hungry leather-jackets which ruin our pastures and crops, and is commonly known as daddy-long-legs. This photograph shows the hollow drill by which she deposits her eggs in the ground.



Harvestman Spider. This angry-looking creature is another sort of daddy-long-legs, known as the harvestman spider. He is a sort of Tommy Noddy, nearly all legs and no body. Like a crab, this insect can shake off its legs when frightened.

being named, must have noticed the fierce appetite and tremendous weapons of this winged wonder, for it stands to us as a tiny edition of the dragons that men pictured as having lived in the twilight of the world. With its enormous eyes, filling more than half the head, the dragon-fly sees everything within its range, and when we watch its darting flight it is hawking for small flying insects. It is in too great a hurry to stop and eat them one by one. It stores its victims in its big mouth as a monkey stores its nuts, and as the grasshopper stores its food in its crop to await digestion. The dragon-fly collects and stores, and eats when it rests, eats with great jaws and powerful teeth—as powerful, in proportion to its size, as the jaws and teeth of a tiger. If human beings were as small as midges, we should fly in terror from a dragon-fly.

If we were weak things, only half as big as caterpillars, what a fearsome creature a looper caterpillar would seem as, clutching the ground with its claspers, it rears itself upright in the air, and throws the front part of its body forward. Still worse would appear the caterpillar of the tiger moth, which really seems to know how ugly it can make itself look, and seems to set itself to alarm us. It has two strange, fleshy streamers at the rear of its body, and a fierce, forbidding-looking head, and it can assume a really terrifying attitude. But this creature is not all outward show. It neither barks nor bites, though we say that its bite is worse than its bark, for it has a wonderful defence. It can throw out a scorching, stinging fluid called formic acid. Now, formic acid is the same fluid with which bees and wasps sting us, and ants inject into the wound their angry jaws have made. And the tiger-moth caterpillar, though it does not sting, can prove more dangerous than some insects that do sting, for one naturalist was blinded for days from the acid squirted into his eye by one of these caterpillars. So let us beware when we see Master Tiger Moth raise himself; he is preparing to fire. The poison sac lies on the under-side of the second segment behind the head. When he raises his body he means mischief, for it is then that he brings his battery to bear upon his victim.



A Looper Caterpillar. Might not this seem to an innocent insect, fresh from the nursery, one of the old extinct monsters returned to life? This caterpillar has the colour of the currant magpie moth, of which it is the offspring.

We have run over only a few features of our insect jungle, which do not ordinarily present themselves to the naked eye. We marvel when a red ant bites us, for we do not see its jaws, and perhaps we do not know of its store of formic acid; we never see the poison duct of the spider at work; we never see the lady cricket with her ears in her front legs, listening to the lively piping of her lover. But the poison ducts and the ears in the legs, and the great biting jaws of the dragon-fly and of the rove beetles, are always at work while the insects are active, and our photographs enable us to see these weapons as the insects see them.

CREATURES THAT MUST FIGHT FOR EXISTENCE

THE AMERICAN BISON, THAT ALMOST BECAME EXTINCT A FEW YEARS AGO, BUT IS NOW BEING PRESERVED

A GROUP OF FLAMINGOES—THESE GRACEFUL BIRDS WERE ONCE ABUNDANT IN FLORIDA

THE GREENLAND WHALE, FROM WHICH WE GET WHALEBONE, AND WHICH IS FAST BECOMING EXTINCT

DISAPPEARING ANIMALS

THE LAST MEMBERS OF FAMILIES WHICH HAVE WALKED THE EARTH FOR AGES PAST

CREATURES THAT FUTURE GENERATIONS MAY NEVER SEE

It is sad to think that the world is growing poorer in animal life. We do not notice the change as we go about our daily work, for our domesticated animals have not decreased. We have millions of horses and cattle, sheep and pigs, dogs, cats, and fowl and we do not realise the destruction that goes on in wild life. But beasts and birds and reptiles are steadily being exterminated by civilised men. Our beautiful wild pigeon has gone, the flamingoes are going, the white heron is almost extinct.

"Well, does it matter?" we may hear it asked. "Of what use to the world are these animals that are being destroyed?" The answer is that we have no right to destroy a thing merely because it is useless to ourselves.

Beautiful pictures and sculptures are useless to savages, but it would almost break our hearts if the treasures of our galleries and museums were destroyed. The Pyramids of Egypt are useless to mankind, so far as actual service is concerned; the unearthed remains of long-buried Pompeii cannot feed or clothe us; the Tower of London could not for an hour defend the metropolis against the attack of an hostile army. But we should never consent to the overthrow of these glorious relics of the past.

And the man who kills the last or any of the few remaining representatives of a dwindling species of animal is guilty of a greater crime than would be the man who destroyed the Pyramids. We could build a copy of the Pyramids, but not all the science and genius of the world could re-create an extinct type of animal life.

We never seem to realise the value and interest of animal life until a species is extinct or on the verge of extinction. Indeed, as soon as any group of animals becomes rare then men of a certain vicious cast of mind hasten to complete the work of destruction. Instead of doing all in their power to preserve such birds or animals in life and health, so that they may increase their numbers, they actually have the few unhappy survivors killed and stuffed, so that they may say, "These are the remains of absolutely the last of the birds or animals of such and such a species."

Of course, it is not the collector alone who commits these crimes. Woman, gentle, tender-hearted woman, as we like to think her, is one of the greatest offenders. The beautiful sable has been almost exterminated, some of the loveliest birds in the world are practically extinct, simply and solely because cruel women, in spite of all that they are told of the abominable cruelty practised, insist upon bedecking themselves with the hide of a particular animal, with the feathers and skin of a particular bird.

In the same railway carriage with the present writer there sat the other day an educated woman talking glibly about human progress. And this woman wore upon her hat the entire stuffed body of a gorgeous bird of paradise. It did not matter that the decoration made her look like some barbarous savage chieftainess, whose costume should have been completed by a leopard's skin, by beads, and by claws of wild animals; but it did matter that she wore a head-dress fashioned, as she well knew, at the cost of the life of one of the most beautiful and rare of all our birds. For a woman to appear wearing such a hat is an insult to all lovers of Nature.

It is a blessing that women cannot wear bison in their hats, or the last few survivors of these splendid animals would have disappeared. The bison is that great animal which once throve in millions upon the prairies of North America, and was always wrongly spoken of as the buffalo. There were many bison in Europe, too, and a small herd is carefully preserved on two of the estates of the Emperor of Russia, amid the forests of Lithuania.

Now, when our fathers were boys, there were known to be at least five and a half million bison in America. They were among the ancient proprietors of the American continent. They were there long before man appeared in the country; they owned the land over which they roamed. Men, when they appeared, hunted the bison for its flesh and for its hide, out of which to make clothing. The bison suffered little harm until fifty or sixty years ago, when enormous gangs of hunters began a general slaughter of the herds. Then the great railways cut into the bisons' pastures, and set up barriers in the way of their migrations, and animals fell right and left, so that mounds of whitened bones marked the paths by which they used to roam. The bison as a wild animal was simply exterminated.

THE HAWKSBILL TURTLE, WHICH GIVES US 'TORTOISESHELL'

One small herd of five hundred was hunted for hundreds of miles. Led by a magnificent bull bison, which could always be recognised from its great size, and from the fact that one of its horns had been broken off in combat—led by this animal, the herd fled from place to place, always with declining numbers, until only half a dozen remained. Finally, only the leader himself survived, and many men tried to kill him. But he was wise and wary and courageous, and though he was several times wounded, the lord of the vanished herd, the last of his race, as it was thought, always managed to make his escape.

At last, when some cowboys went out to collect their master's great Highland cattle upon a ranch in South Saskatchewan, they saw a strange sight. Numbers of cattle were massed round a small spot, and for long could not be separated. When the men were able at last to investigate the matter, they found, to their astonishment, that upon the ground lay the trampled carcase of the last of the bison. The great leader who had defied so many men had been put to death by domesticated cattle. Sick and feeble and old, he had crept to this herd of cattle, and they, following a natural instinct, had killed him. That is the way of many animals, to put an ailing fellow out of its misery, and so the last free lord of the bisons was put to death by tame cattle.

THE NORTHERN SEA-BEAR, OR FUR SEAL

Then men thought that, except for a small herd preserved in captivity, the last of the bison had gone. But we come now to the true romance. One day in 1873 two or three Red Indian hunters, pursuing a herd of several thousand bison, shot one or two animals and put the rest to flight. Now, there happened an incident which is very interesting to us, because it gives us an idea of the way in which early men got their cattle from the wilds. The Red Indians' attack had left four little calves motherless. With the great herd driven away these had no protector, so they quietly trotted after the Indians' horses, and followed them to camp. The Indians presented them to a mission station, where the calves grew up and were treated as tame cattle. In the course of the next four years two calves were born, and from that time onwards their numbers gradually increased until they had to be sold, because they had grown too numerous for private keeping in a small way. In 1884, therefore, two wise men who owned a ranch in Canada, realising that the bison was practically extinct, saw the value of the little herd, and bought ten of the young animals for $2500. Given a free run on a big range, with excellent food and shelter, the herd soon increased, and the owners were able to sell some of their stock. The bison which the United States now possesses in the great Yellowstone Park, where animals roam free, came from this herd which had begun with the four rescued calves. In 1893 the owners bought one or two other stragglers which had been saved from the general slaughter, and they now possessed thirty-six of the animals which were supposed to have become as extinct as the dodo.

In less than a quarter of a century the herd, starting with the four calves, increased to over one thousand head of fine healthy bison, big and bold and picturesque as any that had attracted the greedy attention of men who sought only meat and hides.

Then the Canadian Government did a splendid thing. "We will buy every bison you have got, and keep them all," they said. And they did it, paying $200,000 for the lot. It took seventy-five of the finest horsemen in Canada two months to collect the herd and place them on board trains to be taken to the national park of Canada. As the animals were got together, with their old fiery spirit they would dash at the horsemen who encircled them, and in the end it was necessary to build a great fence 26 miles in length, and, by the help of this, gradually to run the animals down to the railway and get them safely housed in trucks. The bison were all safely taken to Lamont, in Alberta, and after a winter there, where they throve, they were moved on to the National Park at Wainwright, where they have a magnificent home of 160 square miles, with unlimited food, with plenty of lakes, and ample shelter.

It is expected that in the course of the next twenty years the herd will number 10,000, about a twentieth of the number of deer that live in Scotland. During that time numbers will be turned loose to roam in freedom in suitable places, and nobody will be allowed to kill them. Thus, by the single act of a few poor uneducated Indians, this noblest of all American animals will be preserved.

Can this splendid example be followed in other directions? We cannot restore the things that we have lost. We cannot restore those species of zebra that we have wickedly killed: we cannot, perhaps we dare not, give India back the lion. We cannot restore to the sea the Californian sea-elephant. There were only a few living specimens in the world in 1907, and they were killed in order that their remains might be preserved in museums, otherwise they would have been hunted and killed and their bodies boiled down for oil. If only there had been a man with genius enough to protect and save these few animals so that their numbers might increase, as has been the case with the bison, how we should all have admired him!

A FINE HEAD OF AN AMERICAN BULL BISON
From a photograph by Mr. Gambier Bolton, by permission of the Autotype Company, 74, New Oxford Street, W.C.

But there are other sea animals in almost as great danger. It is possible that before the children of to-day reach middle age we shall no longer be able to say, so far as the whalebone whale and the bottle-nosed whale are concerned, "There is that leviathan whom Thou hast made to take his pastime therein." Men are exterminating the whales. The greatest sufferer is the "right," or whalebone, whale. He dies because Nature has furnished his mouth with a marvellous sieve. That sieve takes the form of great plates of whalebone, or baleen, each plate having a sort of hairy fringe. When the whale opens his enormous mouth the water rushes in, and is strained out again through this sieve, and all that is living—tiny forms of living things in which the sea abounds—is caught by the sieve and serves the whale as food.

THE EUROPEAN BUZZARD

Now, it is the misfortune of the whale that man has discovered a use for that whalebone. It is a very valuable product in commerce, worth over $7500 per ton, and to get it men travel every sea to which the hunted whale swims. The animal, though so big and strong, has no chance of escape. It is not like a fish; it cannot breathe in the water, but must rise to the surface of the sea to take in air. When it does so, the whale fishers see it. They see it naturally by day; they see it at night by the aid of electric searchlights. A harpoon fired from a gun carries death to the poor animal, and there is no rest for it by day or by night.

THE OSPREY

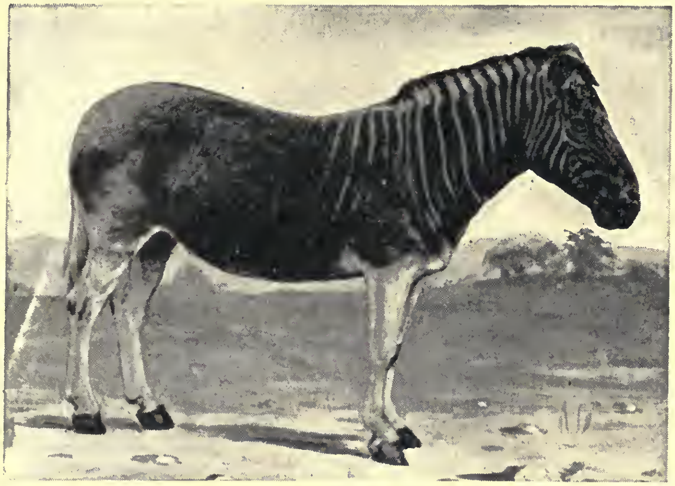
THE EGRET

So long has this persecution continued that there are very few of this sort of whale now in existence. Men have been hunting whales for a thousand years, and it is believed that in that time the slaughter of these animals has averaged a thousand a year, so that a million have died at man's hands. These have not all been baleen whales, of course; there have been great numbers of the sperm whale among them, a great fighting whale with teeth, which is hunted for the value of its spermaceti and oil. But though this monster can fight, and can crush a boat-load of men as easily as we could crush an empty eggshell, it cannot withstand the spear which the gun fires, and in time the sperm whale, too, will totally disappear.

THE HUIA-BIRD OF NEW ZEALAND

The bottle-nosed whale, also, is vanishing. This whale, when full grown, yields about two hundredweight of spermaceti and two tons of oil, so it must die! The poor creature displays great confidence in the presence of ships, sporting round a vessel till death descends upon it. When a bottle-nosed whale is wounded, its companions remain near it in great concern, and do not desert it until it is dead. If, therefore, one whale after another be wounded in turn, the whole school, or herd, may be destroyed, betrayed to death by their faithful regard for one another. In this way, the bottle-nosed whale is being rapidly exterminated.

Seals of all sorts have been subjected to the same merciless treatment, until it has at last been recognised that the hunters are bringing the whole family of these interesting animals within measurable distance of extinction. Some of them yield valuable fur, but the majority of them are killed for the sake of their oil. The practice of the seal-hunter is specially cruel. The parent seals go to desolate coasts and remote islands to rear their helpless young, and are so devoted to the little ones that they remain on land, to be slain with clubs, faithful to the last. Terrible tales of cruelty have come from these haunts, of seals being skinned while yet alive. It is not that, but the fear that the whole family will become extinct, that has brought about a movement for the



GREY'S QUAGGA, WHICH IS NOW EXTINCT

THE MOUNTAIN ZEBRA

THE SEA-ELEPHANT

protection of seals. That movement is to be welcomed, on whatever reason it is based, and hereafter seal-hunters of all nations will have to limit the number of animals they kill, and so give the poor creatures a short resting-time.

The sea-otter is another creature of the deep whose fur men covet. The skin of this animal often sells for $1000 in London, and consequently the sea-otter has become one of the rarest of sea animals. Perhaps no other animal lives in such fear of man. If, when it comes ashore, it smells the smoke of a camp fire burning four or five miles away, it will instantly flee to the water, and so keen is the sea-otter's sense of smell that not until two or three tides have washed the spot will it approach a man's footprints.

Perhaps the okapi shares to the full the horror of man in which the sea-otter lives. This connecting link between the giraffes and the antelopes has been driven by fear into the darkest recesses of the African forest, where, until the other year, no white man had ever seen it, though the little pigmy hunters, armed with their silent blow-tubes and poisoned darts, have long lived upon its flesh. Okapis are wanted for all the zoological gardens of the world, and it is to be feared that its rarity will set so many hunters upon its track as to ensure its extinction

Australasia has three animals under sentence of death. One is the dingo, a wild dog whose history has never yet been fully learned. It is being killed in all directions because of the damage it does to flocks and poultry. The second is the Tasmanian devil, a ferocious little animal which lives in burrows but comes out at night, and commits great havoc among farm stock.

The third is an extraordinary-looking animal called the thylacine, or Tasmanian wolf, a horrid, bloodthirsty animal, without a single good quality except faithfulness to its own kind.

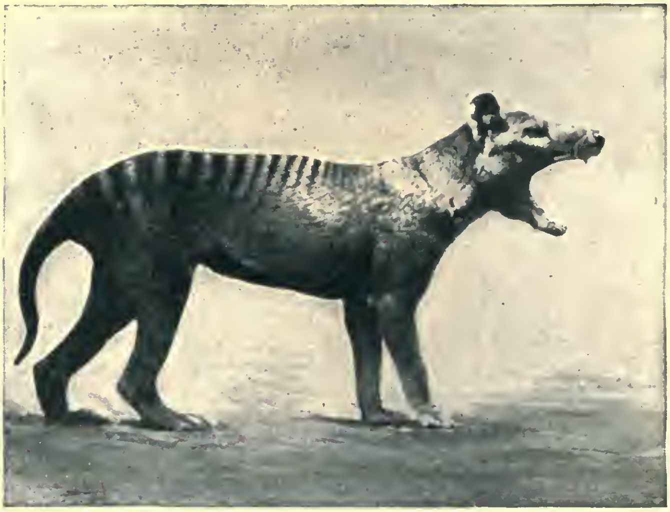
These two Tasmanian villains are to be removed. It is necessary for the protection of farmers' flocks and poultry. But as they are such remarkable animals—as we may see from living specimens in the Zoological Gardens—it is a pity they, like the bison, cannot have some place of their own in which they may be permitted to live. If we could reproduce their like at some future time their loss would not matter. But these strange, primitive animals represent millions of years of Nature's work, and, once dead, can never be replaced.

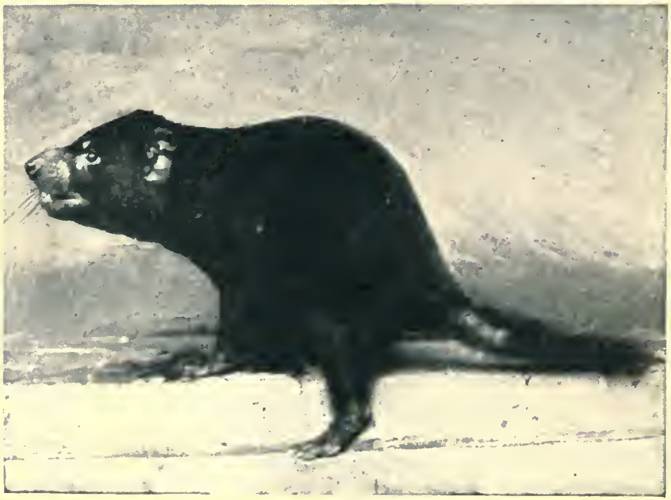
And if that thought moves us to regret in the case of two dull, stupid, but bloodthirsty animals, how much more should it make us mourn the extinction of harmless, beautiful birds!

Men take great pains to collect, guard, and artificially hatch the eggs of trout, salmon, oysters, and even of crabs and lobsters. These are important food supplies, and there is money to be made out of such work, so men cheerfully undertake the duty.

The eggs of the fishes mentioned are now carefully protected, and the eggs of the crab and lobster are to be watched over in the same way. The example in this latter direction has been set by America, where, so great is the demand for lobsters and crabs, and so serious the destruction of females with their unhatched eggs, that even the famous lobster fisheries of the New England coast are becoming exhausted. So, wise in time, scientific American fishermen have set about collecting the eggs that

THE AUSTRALIAN DINGO


THE TASMANIAN WOLF


THE TASMANIAN DEVIL

A GLORY PASSING OUT OF THE WORLD

THE BEAUTIFUL BIRD OF PARADISE, WHICH IS FAST BEING EXTERMINATED FOR ITS MAGNIFICENT PLUMAGE

they may be hatched in protected waters. The same thing will have to be done for the eggs of the turtles used for the soup of ever-hungry aldermen, and those of that turtle which yields the beautiful "tortoise-shell" of commerce. This product is the covering of the hawksbill turtle, and was once obtained by methods of shameful cruelty. That is happily now a thing of the past, but the demand for the shell is so heavy that unless steps are taken to protect the eggs of the turtle the supply will cease.

All these schemes have commercial prudence to help them, but the same thought never seems to apply to birds.

The horrors attending the collection of plumes of herons is almost beyond the power of language to describe, and can best be shown pictorially. Much has been written on the subject in the past, and it seems almost impossible that any woman who reads bird literature, or the public Press, can fail to know the extreme cruelty attending the traffic in wild-bird plumage. The American women who are still willing to wear the plumes of the white herons sometimes offer as an excuse that they are not taken from native herons; but it is immaterial whether the birds were killed in America or in some other part of the world. The same cruelty is practised in the Eastern Hemisphere as in the Western. The paltry price in money that is paid for the plumes is not to be compared to the price paid in blood and suffering.

Women must remember:

That white herons wear the coveted plumes only during the breeding season.

That the parent birds must be shot in order to obtain the plumes.

That the young birds in the nests must starve, in conesequence of the death of the parents.

That all statements that the plumes are manufactured, or are gathered after being moulted by the adult birds, are false. An experienced man has testified to the truth as follows:

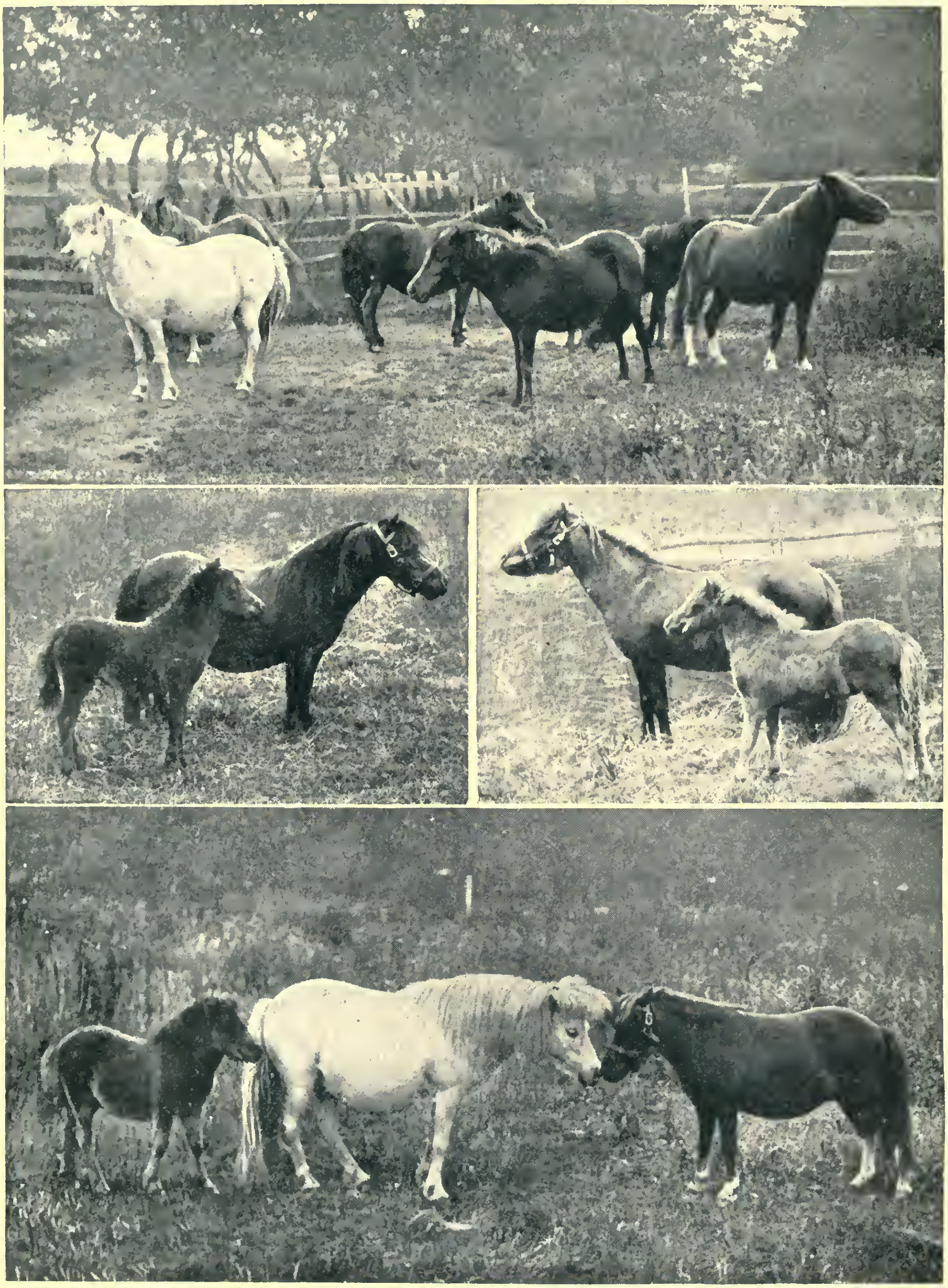
"The birds gather in large colonies to rear their young. They have the plumes only during the mating and nesting season. After the period when they are employed in caring for their young it is found that the plumes are virtually of no commercial value, because of the worn and frayed condition to which they have been reduced. It is the custom in Venezuela to shoot the birds while the young are in the nests. A few feathers of the large white heron (American egret), known as the garza blanca, can be picked up of a morning about their breeding places; but these are of small value, and are known as 'dead feathers.' They are worth locally not over $3.00 an ounce; while the feathers taken from the bird, known as live feathers, are worth $15.00 an ounce.

"My work led me into every part of Venezuela and Colombia, where these birds are to be found, and I have never yet found or heard tell of any garzeros heronnes that were guarded for the purpose of simply gathering the feathers from the ground. No such a condition exists in Venezuela. The story is absolutely without foundation in my opinion, and has simply been put forward for commercial purposes. The natives of the country, who do virtually all the hunting for feathers, are not provident in their nature, and their practices are of a most cruel and brutal nature. I have seen them frequently pull the plumes from wounded birds, leaving the crippled birds to die of starvation, unable to respond to the cries of the young in the nests above, which were calling for food. I have known these people to tie and prop up wounded egrets on the marsh, where they would attract the attention of other birds flying by. These decoys they keep in this position until they die of their wounds or from the attacks of insects."

All birds, if they change the character of their plumage, wear their loveliest dress at the breeding season. The adult birds themselves are shot, and the little ones are left to perish of starvation in their nests.

It is a sad commentary on civilised life that the ancient men of the savage days tamed nearly all the animals that now serve the world, and that modern men have been the means of destroying some of the most picturesque and interesting that survived. There are still primitive, uncivilised men in the world. Men from the cities go among them with modern weapons, and teach them the art of slaughter upon scientific lines, and the example is readily copied, so that skins and skeletons may be ready for sale. We see one result of this in the approaching extinction of the famous musk-ox. This hardy animal, after cheerfully bearing its hard lot in the snows of the Arctic Circle through ages and ages, is now being slowly put to death by Eskimos who have obtained guns and European instruction in the art of animal murder; and the day will come when these animals will disappear from their last retreat, as they vanished long ago from southern lands.

THE LITTLE ANIMALS OF THE LITTLE ISLANDS



FINE TYPES OF THE SPLENDID LITTLE SHETLAND PONIES WHICH HAVE BEEN "WORN DOWN" BY THE STRUGGLE FOR LIFE IN THE LITTLE ISLANDS

THE LITTLE ANIMALS

THE STRANGE STORY OF THE SHETLAND PONY AND WHY HE IS SO SMALL

THE HARD LIFE THAT WEARS AN ANIMAL DOWN

NOT many of us realise that one of the romances of the animal world is presented to us in a Shetland pony.

Think of a carthorse, measuring at the shoulder about 68 inches, and weighing over three-quarters of a ton, and then picture a full-grown Shetland pony of 32 inches, which a man can almost pick up in his arms. Bone for bone, muscle for muscle, nerve for nerve, the two are alike, with the only difference that the pony is a little model of its big relative. Why is one of them a monster and the other a midget?

It will not do to answer that horses are horses and ponies are ponies. The towering giant that trots away with a load of two or three tons, and the midget that ambles along with a child upon its back, both descend from the same ancestors. The horse is a great pony; the Shetlander is a tiny horse.

The noble animal that draws the mighty load descends from a line of horses reared in wide, rich pastures, sheltered in warm stables, fed on the fat of the horse's land; the Shetland pony has become what he is through long ages in tiny islands where food is scarce, where living is rough and wild, where the weather for long periods of the year is cold and damp. He represents the best horse that Nature can support in difficult conditions. The Shetland pony is among horses what a famous English statesman, Lord John Russell, appeared to be to an audience of Devonshire men. Lord John was a little man, and when he first went down to speak in Devonshire the big, burly farmers were disappointed at seeing such a midget. "Ah, my friends," said a merry comrade of the nobleman, "that is the result of the hard work he has done. Of course, he used to be a fine, big fellow like you, but he is so worn by the cares of office that he has been reduced to the size you see." That joke is a sort of explanation of the Shetland pony, which has been worn down to his present size by the cares of getting his living in little islands where the struggle for life is severe. If we turned loose in the Shetlands today a family of the great horses such as we see in our city streets, and left them free to multiply under the conditions in which the ponies live, their descendants would one day be as small as the ponies, unless the hard life destroyed them altogether.

Now, those of us who read this story may see for ourselves a marvel which many of our greatest naturalists have missed. We all know that the immortal Darwin and his friend Dr. Alfred Russel Wallace were led to their discoveries as to the origin of species from their observation of animal life in islands. But they had both to go to the other side of the world to gain their impressions. They did not know that the same lessons were to be learned at home in the romantic little islands of the United Kingdom. Yet the lesson was there to be learned all the time.

Her little islands gave Britain special breeds of ponies, cattle, sheep, and dogs. These are in structure and nature precisely like the animals of the mainland, and yet they are different, different in size and in habits. Jersey and Guernsey have their special breeds of cattle. In the Achill Island, off the west coast of Ireland, where the foxes are wild and fierce as in the days of long ago—becoming so bold in winter that they carry off lambs and pull down a foal that strays from its dam—there are dogs which a famous naturalist declares to be nothing but stunted wolves, exactly resembling their wolf ancestors in colour, in the shape of the ears, and in the masses of hair along the back. Food there is scarce for dogs, and these children of the wild wolf of other days have diminished in size; that is all.

Then the little lonely Scottish island of St. Kilda has a sheep which is like no other British sheep. It is a true sheep in build, in the possession of wool, and so on, yet its hard life has brought about a change of a marvellous character. Its wool is gradually changing to hair, like that of a goat. Hence we see this sheep—the soa, as it is called—with the fore part of its back covered with true wool, and the hind part clothed with hair like that of the goat or the deer. But the Shetland Islands have a distinctive farmyard of their own. Their small ponies are famous, their cattle are the smallest of all cattle, their sheep are about half the size of the typical sheep of the Scottish mainland, and their dogs are about half the size of the collies and Eskimo dogs from which they are descended. In the old days, before Darwin travelled round the world and Dr. Wallace went to Malay, we should have been told that the ponies and sheep and cattle and dogs of the Shetland Islands were created as they are and had remained unchanged; that the curious sheep of St. Kilda had always been a curious sheep, clad half with hair and half with wool; that the little wolf-dogs of Achill Island had always been little wolf-dogs. Darwin voyaged far to learn the truth in distant lands; we profit by his teaching to learn that what is true of the curious animals he saw in distant islands is true also of the islands nearer home.

The animals of such little islands teach us the great lesson of the survival of the fittest, and of what we call adaptation to environment—that is, securing life and welfare, generation after generation, by making the best of the conditions about us. The island animals have grown small and hardy on rough, scanty fare, but boundless freedom, while their cousins have grown big and strong with more food and better keeping. It is only the same thing in animal life that we see in human life. The children who have good food, who live healthy, cleanly lives, flourish physically and make healthy men and women. The children of the slums, lacking good food, cleanliness, and pure air, become puny and stunted. They are the Shetlands of mankind, only they have not the advantage of a splendid open life such as the ponies have.

THE LITTLE SHETLAND DOGS AT KINGSDOWN
The collie in the foreground has won more prizes than any other dog of this breed

Although these brisk, gallant little animals belong to the far northern islands of the United Kingdom, great numbers of them are brought every year by ship to Aberdeen, on the Scottish mainland, and then sent to England by train, or they may go the whole way down to London or other ports by ship. Many of them are now born in England. People who love the animals of the little islands breed them in their parks. There are two or three Shetland farms in England. One is within twenty-five miles of London, at Kingsdown, high up on the glorious Kentish hills. There, in a setting of English rural beauty, we find three of the four kinds of Shetland animals.

Here is a model farm of nearly 250 acres, where Shetland ponies, splendid Shetland cows, and a little pack of Shetland dogs live and romp in perfect freedom. Some day there will be Shetland sheep here, too; but, as these sheep can leap or scramble over a five-foot wall, the day may perhaps be long in coming.

It is a delightful experience to spend a day on such a farm, among these little island beauties, the dogs and ponies as sleek and happy as human care and good management can make them; the cattle fat, prosperous, and tame as petted deer.

To see these little animals in their fat pastures, one would never dream what a long and romantic history they have. Although they are so small, the ponies have records running back hundreds of years. For hundreds of years the ancestors of these midget animals were shut up in the Shetland Islands. They were there before the Vikings! How did they get there? The Shetland Islands are a group of tiny islands in the Atlantic, nearly a hundred miles north of the northernmost point of Scotland. Between the Shetlands and the Scottish mainland come the Orkneys, lying south-west of them. Away due east the nearest land is rugged, romantic Norway, with the port of Bergen only 220 miles away. Now, ponies do not grow out of nothing. How came they to be in these islands, so far away from other lands and other animals? Well, that is a wonderful story.

There is an old saying that all the Scotsmen are in Ireland, and all the Irishmen in Scotland. It is true that long ago there was a great exodus of Irishmen to Scotland, and a great movement of Scotsmen to Ireland. Now, so far as we know, the Picts were the first owners of the Orkneys and Shetlands, but we cannot tell whether they took horses there with them from Scotland. The Irish were the first modern discoverers of the Shetlands. They sailed away from their own Emerald Isle over twelve hundred years ago to the Shetlands and Orkneys, and they took their ponies with them in their little boats. They were Celtic ponies, reared in Connemara. But the Irish did not make any real settlement in Shetland. About a hundred years after they had discovered the islands, however, the Vikings rediscovered them. These hardy Norsemen had already colonised the Orkneys, the Hebrides, and part of Ireland; but in the ninth century, rather than submit to the rule of a tyrant king, they sailed away north to the verge of the Arctic Circle, where they found Iceland. A number of Irish went with them, and these, or the Vikings themselves, took ponies with them.

We can imagine what extraordinary nerve they must have had to carry horses in their little cockleshells out into the unmapped

THE SHAGGY SHELTIE IN HIS WINTER COAT

ocean. The ancients, who knew of the Shetlands, considered them to be the end of the world, but these Vikings sailed away with their ponies towards the world that was supposed not to exist. Descendants of the ponies they took with them are still in Iceland, famous little animals, preserving the characteristics of the Celtic stock from which they were derived. During the Iceland winter these ponies are fed on fish refuse, and it is owing to this, no doubt, that the Iceland pony's head has never grown coarse. Wild horses, of which there are still some herds remaining on the Asian steppes, have very coarse, heavy-jawed heads, as the result of the great teeth they must develop to grind up the tough, hard food on which they have to subsist.

So the Orkneys lost their ponies and Iceland gained them, but the Shetland Isles were never deprived of theirs. The Shetlands continued to be inhabited, under their old Viking name. Shetland is a modernised spelling of the old Viking word "Hjaltland," which means high land. The *hj* in Scandinavian is pronounced as if it were *sh*, so that we see how the pronunciation arises. The Vikings called a Shetland pony a Hjeltie, or Sheltie, so that in speaking of these ponies we are using a Viking word without knowing it.

FRIENDS

During the centuries that have followed since the Shetland was taken from his native Ireland he has grown smaller and smaller. Bigger horses could not survive the hard living and bad travelling. Much of the surface of the islands is divided between rocky hills and boggy land. The light-bodied ponies manage to scramble over the surface, where big horses would sink. When carrying a man on its back, a native Sheltie will get up a hill on its knees. Not that they cannot leap. A Sheltie, known to the writer, and now grown into a giant of 38 inches, leaps up and down the terraced lawns like a rabbit when he escapes through his open stable door. In the islands the ponies assist with the ploughing and carry heavy burdens on their backs. They are, for the most part, born in the open; they live in the open and die in the open. They live on the roughest fare, the scanty herbage of the islands, coming down to the coast in the winter to browse on the seaweed.

In the very old days there used to be hippopotamuses in Cyprus and Malta. They must have wandered there before the land-bridge which once connected the islands with the mainland of Europe broke down. When they became shut up in the islands the hippopotamuses grew smaller and smaller until they dwindled to the size of pigs. Then they died out. The Shelties have dwindled in size until now they are the smallest horses in the world. But they are not going to die out. If they have grown small in body, they have grown large in brain, and it is very doubtful if there is any breed of horses more intelligent, more teachable, more lovable than the good little Shelties. Want and privation have sharpened their wits. The weaklings and the stupid ones have perished; the best, the cleverest, the hardiest have survived, and today we have in them a race of little horses which, in proportion to their size, can bear more fatigue and endure rougher usage than any other form of domestic animal in existence. There is no more useful little animal alive, perhaps. "When I am in the stable with Charlie and no one else is near," says a great friend of these ponies, "I should never be surprised to hear him *speak*. He really understands what I say to him." She walks up to his side and says, "Beg, Charlie," and the little beauty stands upon his hind legs like a dog. "Say your prayers," she bids, and the Sheltie goes down upon his knees and bows his velvety muzzle to the ground.

THE SHELTIE THAT WILL STEAL UP BEHIND THE GARDENER AND TAKE HIS CAP

My friend's pony Jack has never been taught tricks, but he has some of his own. He used to creep gently up behind the gardener, seize his cap, and run off with it as for dear life. He would also steal her apple when she trotted, as a little child, back from the orchard, and when she thought to deceive him by hiding the fruit under her pinafore he would thrust his little head under the pinafore and still get the apple.

And at other times Jack would play hide-and-seek. Darting away at the sight of one of his friends, he would rush up a side path and pop behind the bushes, and then, as his friend reached his hiding-place, he would dash out with a neigh that really seemed to say, "I've found you." He liked to do the hiding and the finding as well. He was never taught to knock at the door of his stable on hearing his little mistress's footstep, nor to put his forefoot into his manger and tap the iron to call her, but he does both these things. Jack is no saint, so the maids declare, for, as one of them carried a basket of clothes to the drying-ground, he would walk demurely by her side for a space, and then suddenly grab a bundle of spotless linen in his mouth, fling it contemptuously on to the grass, and run. "That pony's an imp," the girls would say.

THE WORLD THAT OPENS OUT TO THE SHELTIE WHEN HE LEAVES HIS HOME

Shetland ponies, once they leave their native land, have three or four possibilities. They go either to circuses, where they are to be pitied, or they become the pets of children, when, if they are properly treated, they should be perfectly happy. Given sufficient good food, but not too much corn, with plenty of air and exercise, and never, never whipped, the Sheltie is in his element. Or, again, we see them at their prettiest as a four-in-hand, drawing a little carriage in the country. That is no punishment to them, for they are very strong. A good Shetland, if we examine it carefully, is found to resemble a tiny shire horse in the build of the body, but with beautiful fine legs, like those of a little Arab steed.

These qualities give them strength and speed, and they are built to last. A Shetland islander at home does not consider his pony really grown up until it is nine or ten years old, and then he expects it to work for him quite twenty years. Full grown, the ponies vary between just over 30 inches to 44 inches in height at the withers—where the neck joins the back. If they are more than 44 inches high, they are not regarded as real Shetlanders. They are not very dear, unless those with long pedigrees be bought, such, for example, as Charlie, the famous prize-winner at Kingsdown. He is not to be sold, but if he were he could not be bought for a penny less than $300. Ordinary Shelties of this breed can, however, be bought young at from $50 to $125. The small ones can never be cheap, for, although few people realise it, the Shetland ponies are part of the backbone of Britain's wealth.

THE SAD TOILING OF THE LITTLE PONIES IN THE MINES

If it were not for these ponies British coal-mines could never have been developed, and where would the greatness of England have been then? There are about 3000 collieries in that country, and it is sad to remember that in the great majority of them horses are used — and were the only means available before the days of electricity — for hauling the coal along the galleries to the bottom of the pit-shaft. The galleries along which the little coal-trucks run are so low that in most cases only Shetland ponies can walk there. For generations these lovely little animals have been toiling down in the mines. They are doing so today, and will continue the terrible work so long as coal is mined in collieries where the conditions make it unsafe to use electric power. There is a constant demand for Shelties for the mines, and the smaller they are the better they are for mining work, provided, of course, that they are strong. That is why we have them shaped as they are, with such splendid bone and muscle on such tiny frames, for care is taken, where the ponies are looked after, to see that only the best strain of animals is kept to send their descendants forth among the workers and pets of the outer world.

The little friends of these ponies, the Shetland dogs, are the descendants of Scotch collies and Eskimo dogs. In the old days the Scottish shepherds, going up to the Shetlands to fetch the fine little island sheep, would give the islanders some of their dogs, and fishermen and whale-hunters, coming down from Greenland and Iceland, would bring Eskimo dogs with them and leave some in the Scottish isles. Both the Scotch and the Eskimo dogs are much larger than the Shetland, but a special Shetland type has been produced, small, like all the rest of the animals. The perfect Shetland dog should be only 12 inches in height and 12 pounds in weight. Their work at home is to look after the sheep, to collect them on the hills, and bring them to the master's fold, or, when the little woolly robbers come down at night to raid the haystack or the crops, to drive them back to the places where they should feed. They are very light and active, as dogs need be if they are to deal with Shetland sheep, they have beautiful collie-like coats, and they have the fine, intelligent, pointed head of the true collie. They are only now becoming known in England, but they are highly valued as pets for their amiability, intelligence, and faithfulness. They are delightful companions for children, just as Shetland ponies are.

Nobody quite knows where the Shetlanders got their cattle. They are as distinct a breed as the lovely little Jerseys. They are small, as we have seen ; so are the Iceland cattle. They live on rough fare, as do the Icelanders, yet they give a remarkable quantity of milk. A good Shetland cow will yield nearly three gallons of milk a day. They must have received much more attention in past ages than the ponies. The ponies, when winter comes, put on a mighty overcoat of thick, shaggy hair, which defies rain and snow and wind. But the Shetland cattle have beautiful, close, sleek coats, and the skin is soft and silky. The docility and gentleness of the cows, too, proves that for a long time they must have been in close touch with kind men and women. Although they do not really like to have strangers near them, the Shetland cows will remain placidly feeding in the pasture while someone whom they have never seen before goes up and strokes and pats them. The rigorous climate of the islands has exterminated the weaklings, and Shetland cattle are said to be quite proof against the deadly disease tuberculosis.

A PRINCE OF SHETLAND

THE LIFE OF THE SHELTIE IN SHETLAND

THE SURE-FOOTED SHELTIES SEEKING SEAWEED IN THE WINTER ON THE SLIPPERY ROCKS

SHETLAND PONIES CARRYING HOME THE BASKETS OF THE FISHERMEN

There would be a fine tale to tell if we could trace the history of these cattle in the Shetlands. Nobody has yet been able to do so. Those who study the cattle believe that they are of Scandinavian origin. This means that the Vikings of old must have taken their cattle with them, as the Irish took their ponies. It is a very interesting suggestion, and a probable one, too. There is another suggestion, not less romantic—that some of the ships of the Spanish Armada, which were wrecked off the Shetlands, had Spanish cattle aboard, and that some of these escaped to land and lived to leave descendants. This, again, is not at all unlikely, and the Shetland cattle may be descendants of Viking and Spanish cattle, with a really wonderful place in history.

THE MYSTERY OF THE SHETLAND CATTLE THAT MAY HAVE COME FROM SPAIN

Expert judges declare that there are in Shetland cattle certain peculiarities found in no other cattle save those bred in Spain for bull-fighting. A famous breed of Spanish cattle is owned by the descendants of Columbus, and one wonders if these little Shetland cattle are descendants of those which lived in Spain when Columbus was alive. Columbus himself may have visited the Shetland Isles on a voyage to Iceland, where the cousins of the Shetland ponies were, and where, it is quite possible, the great traveller first heard of the existence of the New World. Be that as it may, it is possible that the mingled blood of Viking and famous old Spanish cattle runs in the veins of the stately little cattle that we find on the top of the Kingsdown Hills.

The origin of the Shetland sheep is not more clear than is that of the cattle. If the Vikings found them in the Faroe Islands, as has been thought, they may have found them in the Shetlands. Some authorities believe that the Vikings who fled from the tyrant king took sheep with them to the Shetlands, and that those of today are descended from that stock. They must have been there for a considerable time, or they could not have become so altered from the rest of the Scottish sheep.

THE LESSON THAT THE LITTLE ISLAND ANIMALS TEACH THE WORLD

Time is of no account to Nature, but she must have leisure for her works, and the Shetland sheep is decidedly one of her masterpieces in the way of fitting animal life to its surroundings. These sheep are very much smaller than the sheep of the rest of the country. They are as active as goats, and climb where even the nimble, sure-footed Sheltie cannot go with safety. They are fleet of foot and venturesome, long-horned and heavy-woolled, and they are small enough to fit appropriately into the tiny islands which form their home. Like the ponies and the dogs and the cattle, they have sacrificed only size, retaining all the other virtues.

Such are some of the animals of the little islands. They are interesting for their own sakes, interesting, charming, and fascinating, but they have a value as a natural object-lesson which none of us should overlook. They are what they are because Nature has insisted that they shall take this form and size—or die. They are an example of the effects of natural surroundings. We see in them a tiny picture of one way in which Nature's laws work throughout the world, and through all time. These animals, taken to the islands and shut in by the boundless sea, are left for ages slowly to adapt themselves to changed conditions of life, and by succeeding they show us how new species have originated in the past.

HOW MAN TRIUMPHS OVER THE HARD LIFE THAT WEARS DOWN ANIMALS

The Shetland pony and the Shetland sheep are, in their way, as wonderful as the kangaroo and that strange animal the egg-laying duckbill of Australia. The Australian animals were shut up in an island-continent at a time when the entire animal family was of a lowly type. Barred from intercourse and protected from competition with other forms of life, the animals of Australia have changed into forms unlike any other animals in the world. The animals of the little islands have made their change within the days of history.

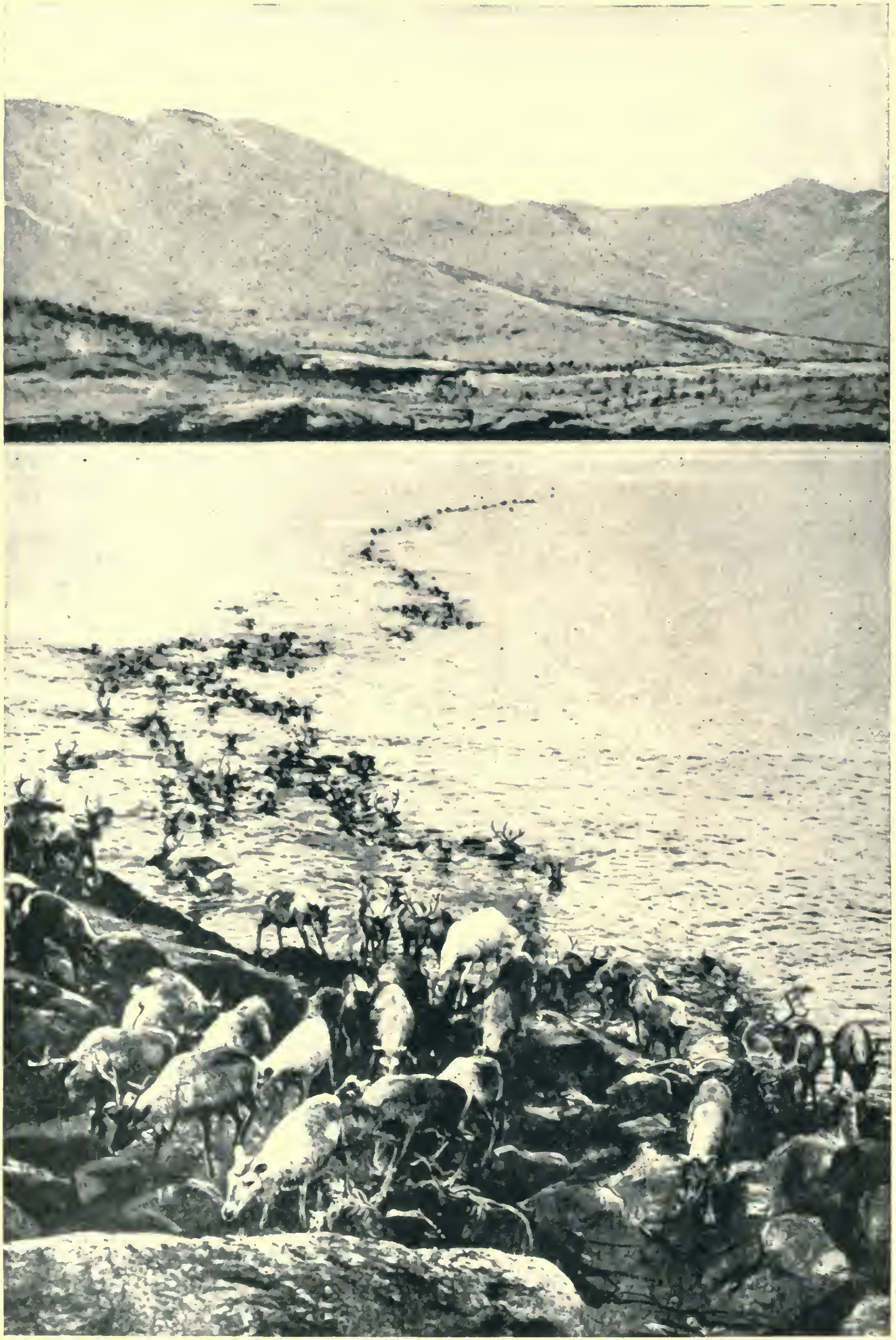
We see from these two examples, so different yet so alike, how Nature brings about her changes. We see, too, how it is that man alone is able to spread all over the world unchanged in form. He alone, of all creatures, is able to pass all barriers, to climb mountains, to adapt himself to changed conditions of climate. In the less exalted scale we find great varieties of life occupying distinct areas, over the whole of which any member of man's family may roam. The river which bars the path of the lion or the monkey forms the highway of the fish; the mountain barrier which the teeming animals of the prairies cannot cross forms a footpath or a tunnel for man. Rivers and mountains, seas and lakes, are his highways. Man alone can travel over them all, transporting horses and cattle and sheep for the future to marvel at, as we marvel today at the animals of the little islands.

THE LITTLE PONY'S GOOD-BYE TO ITS HOME

THE LITTLE PONIES AT HOME ON A FARM IN SHETLAND

EMIGRANTS FROM SHETLAND—SHELTIES LEAVING THEIR ISLAND HOME

A GLORIOUS ANTLERED HOST IN LAPLAND



REINDEER CROSSING A SOUND IN NORWAY—THE LEADING REINDEER IS PULLED THROUGH THE WATER BY LAPLANDERS IN A BOAT, AND THE REST FOLLOW THEIR LEADER

THE GREAT WINTER MYSTERY

HOW THE ANIMALS GO TO THEIR TAILORS AND CHANGE THEIR COATS WHEN COLD WEATHER COMES

THE CHANGE THAT COMES OVER WILD LIFE IN WINTER

THOMAS CARLYLE wrote a famous book called "Sartor Resartus," which he pretended was all about clothes. In it he poked fun at his fellow-creatures, who are, he says, in one thing inferior to the horse, which is admirably clothed in its own skin, whereas men and women and children must dress up in the skins of many creatures and the product of many trades.

But young people whose fathers keep horses, or who have ponies of their own, might have puzzled our philosopher by telling him that, while the horse has only one natural covering, the horse in winter appears to be quite a different animal from the sleek and glossy creature that we meet in summer. Between summer and winter the horse seems to pay a visit to his tailor. He appears in winter in a brand new coat, a grand hairy ulster, which defies the wind and rain. That is, of course, unless we clip him, cut off his hair, and singe it close.

But a clipped horse is not the horse that Nature designed; she gave the horse a covering which would keep it warm in winter. Wild horses must stand about to crop their food; they must lie out unsheltered at night, and as the cold of winter increases, so the hair of the horse grows longer. It grows all through the winter, and the domesticated horse needs constant clipping and painless singeing.

At first sight it might be thought cruel to deprive the horse of its winter covering, but it is not actually so. It is really kind, for it is cruel to work horses hard when they are covered with long hair. The domesticated horse is supplied with abundant rich food which it could not get in a wild state, and that food makes it strong to labour; but its labour makes it very hot, and in its winter coat it would suffer torture from heat. We strip from it the covering which produces excessive heat, and keep it warm with work and food and rugs and wraps.

But look at the horse that winters out, as we say, and then we see the effect of the visit we may fancy it has paid to its tailor. It very soon wears a luxuriant growth of hair, which is a better covering than anything we can provide. When such a horse is brought in from the farm or ranch in the spring, it is given rich food, and is covered with thick rugs and made to run about in them, to reduce its fat and make it cast its coat. This may be seen where numbers of horses are kept and trained; but there are visits to the animals' tailor of which most of us know nothing. Cats and cattle and many other animals put on winter coats, and very strange and puzzling some of these coats are. They are not only longer and thicker than their summer coats, but are actually of a different colour. If a black man turned white in winter we should think it an amazing thing, but that is what happens among the animals, only with them it is not the skin, but the covering, which goes through this wonderful change. Animals which are brown and blue in summer become snow-white in winter; those which are a glorious ruddy red in the burning heat turn grey when snow lies on the ground.

But the wonder does not end here. All the male deer of our land, which are bare-headed, as we may say, during the early part of summer, go into hiding, and, when winter is approaching, come out equipped with enormous antlers. Clearly they have been not only to the tailor, but to the armourer.

It is certain that any of us who know the country and its life could deceive a man from the town by showing him the same deer in summer and in winter; he would think the winter deer quite a different animal from the deer he saw in the warm days of the year. Better still would be the case of the weasel, which so deceived mankind that it was given a second name, and is also called ermine. The weasel and ermine are one and the same animal; the ermine is simply the weasel in his winter suit.

There is no other tailor so wonderful as Nature, and the weasel is one of the best examples of her work in that respect. In the old days people did not understand the great care that Nature takes of her lowly children. They saw this little animal in its lovely winter coat, and never dreamed that it was a weasel, and their mistake imposed a fraud upon England as a nation, and, indeed, upon civilisation itself. This occurred because the heralds adopted the ermine as the emblem of purity, and old writers wove the most wonderful stories round the little animal. It is still commonly believed, all over the colder parts of the world, that the ermine is so scrupulously cleanly that it would suffer death rather than be dragged through mire, and probably millions still believe the old legend that if the ermine is placed within a ring of mud it will kill itself rather than contaminate its spotless fur.

And so the heralds, with their pomp and ceremony, chose the ermine as the token of purity, and what the heralds said the law adopted. Judges in Great Britain wear robes edged with ermine to show that pure justice is administered in their courts; and Queen Elizabeth, when she wished to have purity suggested in a portrait, chose the ermine as its symbol. At Lord Salisbury's house at Hatfield she appears in a painting with an ermine crawling up her arm! What a scream of horror and disgust she would have uttered had she known that this emblem of unblemished purity is simply the winter coat of the little ruddy weasel, cousin of the evil-smelling polecat; that, so far from being a gentle example of pure living, it is really one of the fiercest animals in the world, a bloodthirsty little rascal which kills merely for the joy of killing!

ARCTIC FOXES AT THE ZOO

Nobody would buy a weasel's skin, but ermine is one of the most beautiful of all furs, for which the highest prices are paid. This white fur is simply meant to deceive, and it does deceive. It is meant to render the weasel unseen in the snow, so that it may creep unnoticed upon its prey.

Now we come to a puzzle which must often have perplexed little heads, for, as every young Englishman knows, we see weasels in the English winters as brown as toast. Why is this? The reason is that, where weasels remain brown throughout the year, the average weather is mild during the winter months, and the snow does not lie for long periods. Even our grandparents, who tell us that they fancy the old-fashioned winters were more severe than those of the present time, cannot remember a winter in which the snow lay for any really long time on the ground in England or southern Scotland. But the case is different in the north of Scotland and in the lands nearer the North Pole.

Take up the atlas for a moment and run the finger along the parallel of latitude which cuts across the upper portion of Scotland; follow it to the right across Europe and Asia, and to the left cut across America. That gives us a vast tract of the world, but throughout all that huge domain we should be unlikely to find a brown-coated weasel in winter. We find weasels right away down in the south of England — not long ago in a hard winter they became a dangerous pest in Devon and Cornwall, and attacked human beings. We find them still farther south in Europe, a thousand miles nearer the hot lands, right away in southern Italy. All the Southern weasels retain their brown coats. All the Northern weasels obtain the aid in winter of Nature's tailor. But they do not change their nature with their coats. Every bit of ermine on the King's robes, every bit of ermine on the robes of dukes and duchesses and the great judges, is simply the covering of the weasel, changed by the blanching hand of winter from brown to spotless white.

Another puzzle is the fur of the Arctic fox, for we hear of the white foxes and the blue foxes, both dwelling within the Arctic Circle, and we know that some of them do not change their coats. There are Arctic foxes in Iceland which are always blue; there are blue foxes in other Arctic lands which become in winter as white as the snow. How is it that one blue fox changes his coat, while others, living close by, do not?

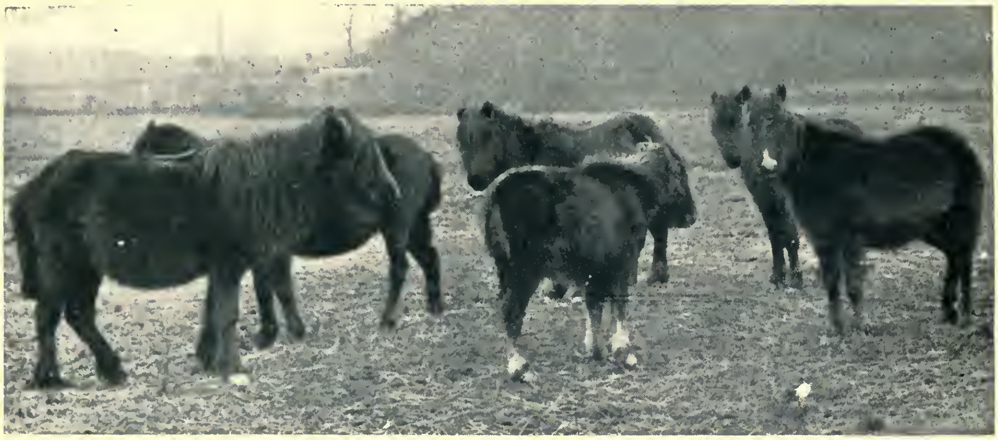
We find white foxes and blue foxes inhabiting not only the same continent but actually the same islands. If one variety of foxes finds it necessary to put on the robe of white, why do the others remain blue ? Nobody can say, but a great naturalist has made a most interesting suggestion. His theory is that as Arctic foxes lay up stores in summer, when they are wearing their dark-coloured furs, and live upon these stores during the winter, therefore they do not need the help of the white-handled tailor. It is possible, then, according to this idea, that the foxes which remain blue throughout the year may be reverting to the condition of their old-time ancestors, which had not found it necessary to change for the winter from blue to white. The white variety is the newest thing in Arctic foxes ; the blue represents the old stock.

THE ARCTIC FOX IN A SNOWSTORM

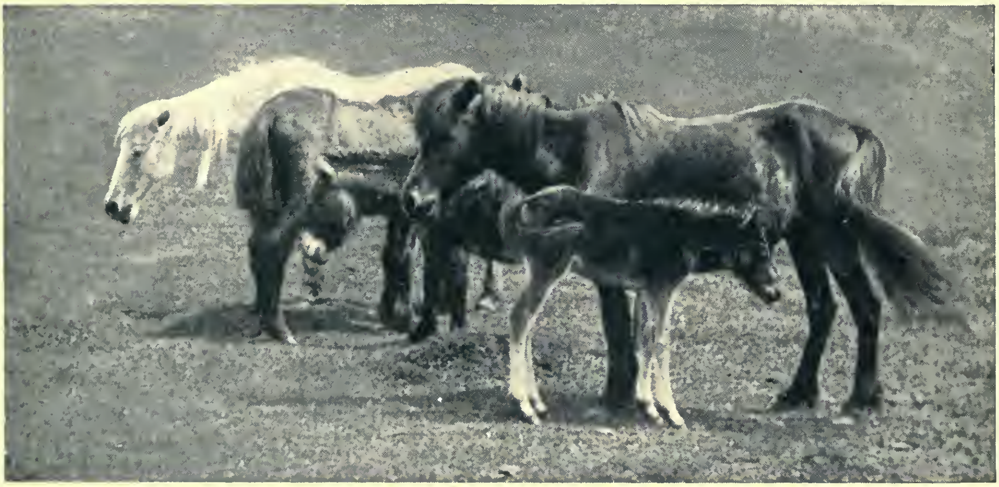
But the fact that these foxes lay up stores for winter is very strange. We know this is most unusual in flesh-eating animals, and the Arctic fox is the only big flesh-eater which practises this wise economy. Many travellers in frozen lands, seeing Arctic foxes with not another living animal small enough for them to kill, wondered by what miracle they survived, and one hardy explorer awoke to find a fox gently eating the skin rug on which he lay. But there are not enough travellers' rugs to go round among the foxes, white or blue, and what really happens is this. Parts of the range of the Arctic fox are alive in summer with lemmings and nesting birds, and the foxes kill great numbers of them, hiding their bodies in crevices in the rocks, in galleries excavated by themselves, and in other places. An Arctic fox will bury the bodies of fifty lemmings together. Where there is a lemming colony, there we find these great burial-grounds of the small animals, all preserved by the cold for the winter fare of the clever Arctic fox, which, alone among all the flesh-eaters, seems to think of tomorrow.

Now, if provision is made in this way, the blue Arctic fox need not worry about a white coat for winter, for he will not need to go hunting when the snow comes. He will stay at home in his own burrow, eat his stores, and sleep away the dark winter night which lasts for so many months of the year. But that is only a theory, and it is really difficult to understand. The question, of course, arises, " Is it only the blue fox which lays up stores and so needs no vestment of white ? " That cannot be answered, and seems to be without an answer. The lemming, as well as its enemy the

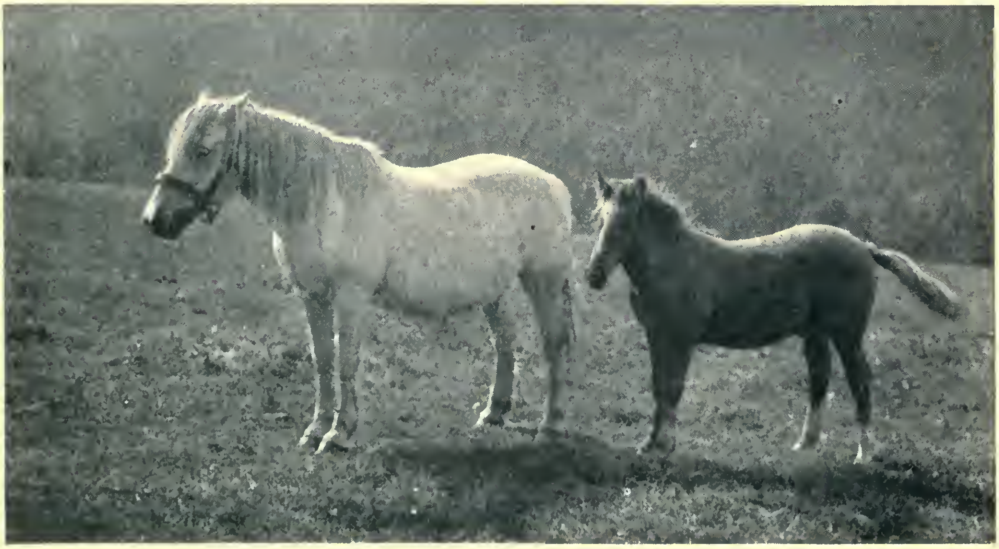
THE NEW FOREST PONIES & THEIR NEW COATS



A GROUP OF SHETLAND PONIES IN THEIR WINTER COATS

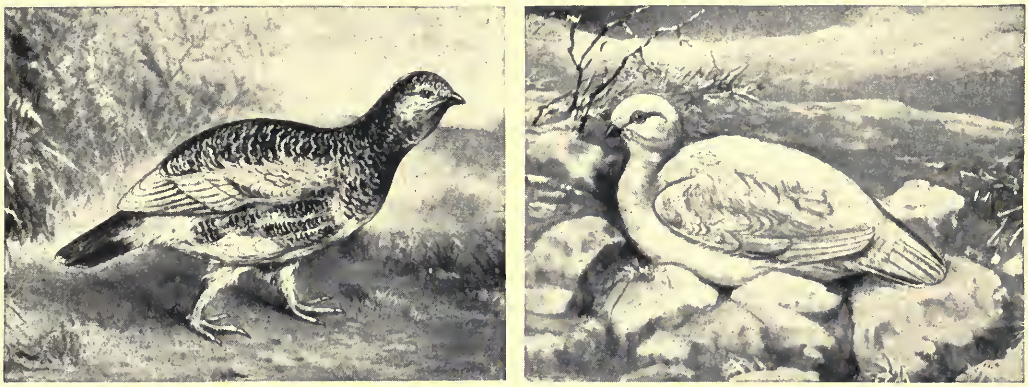


PONIES SHEDDING THEIR WINTER COATS AT THE COMING OF SUMMER

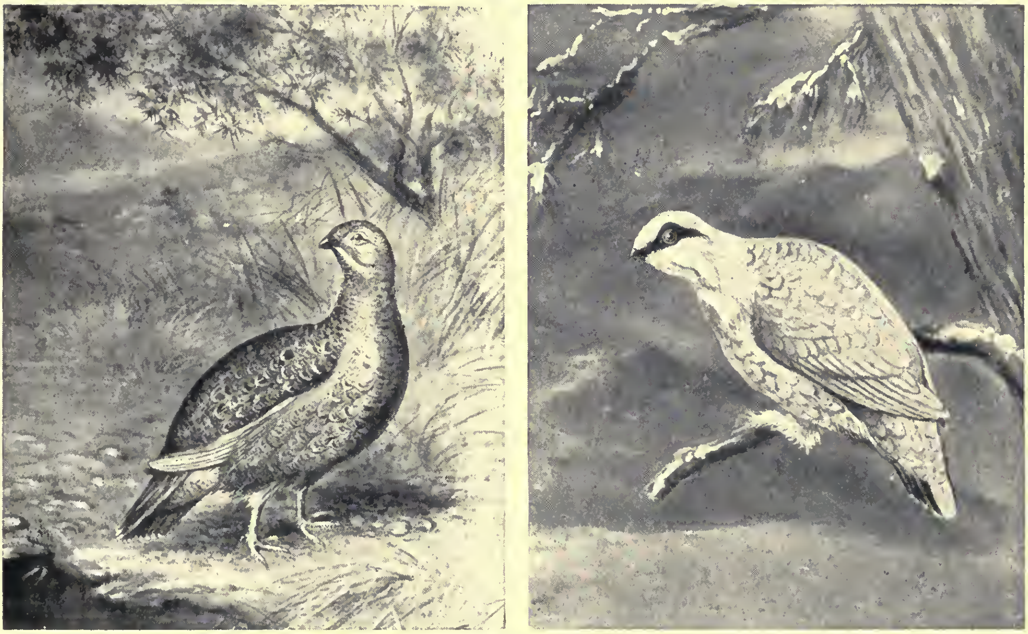


PONIES OF THE NEW FOREST IN THEIR SUMMER COATS

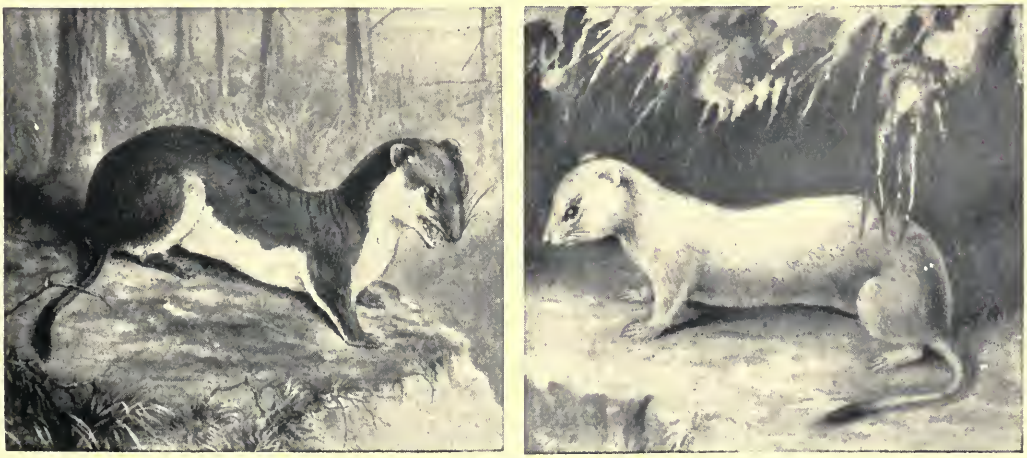
CHANGING THEIR COATS FOR THE WINTER



SUMMER **Ptarmigan** WINTER

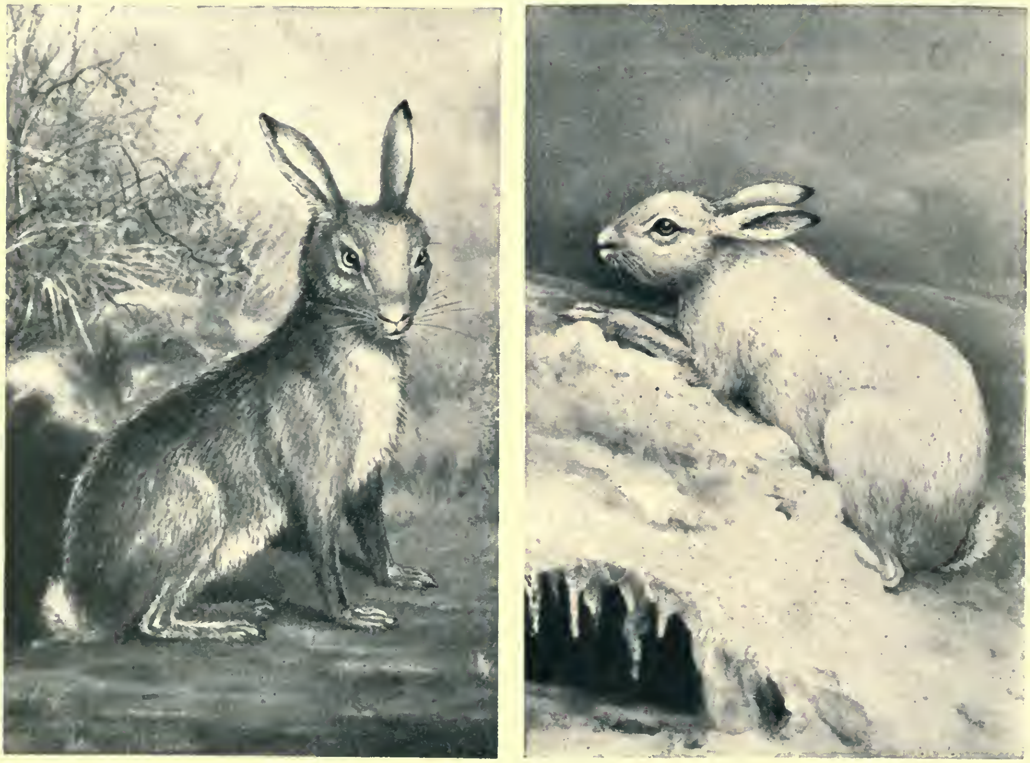


SUMMER **Willow Grouse** WINTER



SUMMER **A Weasel** WINTER

fox, turns white. It has been found that some animals from cold climates, even if taken to winter in warmer regions, turn white at the usual time. But there was a lemming, famous in science, which showed that it is cold that fixes the time for the lemming to put off colours and don his spotless garb. This particular lemming was brought to England from the Arctic and kept in a warm place until mid-winter. It ought by that time to have been white, but it remained a summer brown. Then, suddenly, it was exposed to an artificially low temperature, such as would have been natural in its native land, a cold too intense for English stay-at-homes to realise. The effect was wonderful. In a single night the hair of the lemming's head was bleached, and in less than a week its coat was completely white.



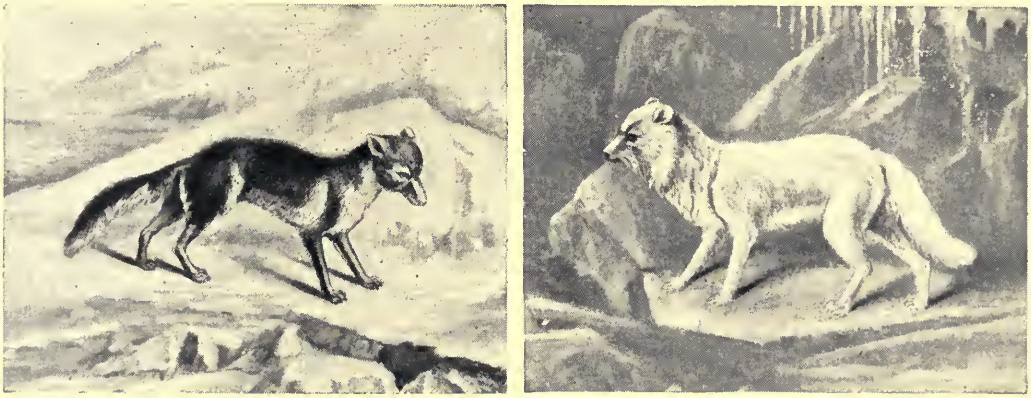
THE MOUNTAIN HARE IN SUMMER AND IN WINTER

How do the animals change their coats? It is a mystery that no man knows. Naturalists used to think, and some still think, that the change is brought about at the will of the animal itself. But that is absurd. The animals which bleached in a climate made warm artificially would not deliberately whiten their coats in a green land, where they would thus become conspicuous and exposed to the view of their enemies and their prey. Animal hair is governed by very much the same laws as those by which human hair grows. When our hair "stands on end" from fright, or from anger or cold, we realise how little control we really have over this covering of our heads. Each hair is provided with a tiny muscular system, and when we are startled a tightening of the scalp contracts these muscles, so causing them to erect the hair. But we cannot direct or control them. Possibly the great man-like ape can; when it is roused to passion it causes the hair upon its scalp to rise, much as we raise our eyebrows. But that is different altogether from changing the colour of the hair. The colour is caused by a substance called pigment, or colouring matter, to which, particularly in white hair, is added a number of the tiniest of air-bubbles. When that pigment is injured or destroyed, a white hair remains.

We may watch the process taking place in a man whose hair is turning grey. It is that same process which takes place in the animal which is being tailored into a winter costume. With human beings the whiteness generally begins at the roots, but with animals it commonly appears first at the tips—a brilliantly clever precaution by Nature, as we may say, seeing that the first thing to be done is to adopt safeguards against detection. When the hair of an Arctic animal begins to pass from the summer to the winter phase, the tips are whitened and the rest of the hair slowly follows suit. If we turn back the hair of such an animal before the process is complete, the summer hues are discovered below, just as in ruffling the short nut-brown hair of an agouti guinea-pig we reveal the striped sections of hair below, resembling the quills of the porcupine.

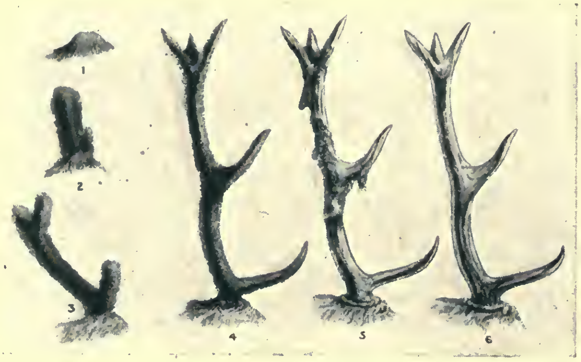
But all this leaves unanswered the question as to what *causes* the effect we see. So far the only man to come anywhere near the actual solution is the great Russian scientist Metchnikoff, who believes that under certain conditions microbes swiftly devour the colouring matter in the hair, and leave a hair, previously brown or black, quite white. That would account for the whitening of the old hair of the animal, and for the destruction of pigment in the new hair, which, white on emerging from the skin, remains white until it falls out, when spring and hot days call a new coat for summer into existence. Possibly, if this theory is true, the sudden coming of cold, by enfeebling the flow of nourishment to the hair, prepares the way for the rapid attack of the tiny organisms which devour the colouring matter. A caterpillar will attack feeble foliage, while leaving hard, healthy leaves untouched; and fruit-growers, profiting by this knowledge, discard trees with soft leaves and substitute those with tough, woody leaves, which the jaws of ordinary caterpillars cannot gnaw.

If the Metchnikoff theory is correct on this point, we may still marvel at the speed with which a winter change of colouring is brought about. But then we have to look at human records and remember how suddenly the hair of men and women, under stress of great fear and emotion, has changed from dark to white. The hair of Queen Marie Antoinette of France went white during the awful Revolutionary days which led up to her execution, and the same thing happened to one of her friends, Mme. Roland. The most surprising thing of all, however, is recorded by a British Army officer, Surgeon Parry, who was present in India during the Mutiny, and witnessed the trial of some of the rebel Sepoys who had been captured. One of these, he says, was in such fear of a terrible death that his hair, black as a raven's wing, changed to grey *in half an hour*, before the eyes of all who watched.


THE ARCTIC FOX IN HIS SUMMER AND IN HIS WINTER COAT

Leaving the white-coat animals, let us turn for a moment to the birds, and ponder briefly the strange case of the ptarmigan. This bird is indeed a turn-coat. Three times each year it changes its garments. The summer raiment is a fine mixture of shades—dark brown, black, grey, buff, and red. In autumn the plumage changes to a handsome grey, neatly mottled with black. With winter comes a further tailoring, and this time the bird puts on snowy white, except for a black outer edge of tail-feathers, and a tiny tract in front of each eye, where black again appears. There is a further interesting thing about this bird.

In Scotland, where the winters fall far short of Arctic severity, the ptarmigan rarely gets its coat completely white, but now and then, in a really cold Scottish winter, it does change completely. In other lands farther north, where the winters are longer and colder, the plumage of the ptarmigan is pure white in severe weather, but in the same lands, where the summers are shorter and cooler than ours, the ptarmigan never quite gets rid of the winter covering, carrying a certain proportion of cold-weather feathers until the time for the complete winter wear has come round again. Possibly the same law operates here as in the case of the ermine's hair, for hair and claws and nails and horny hide all arose, in the early days of animal life, from the same substance, the covering of skin which man and beast and bird and reptile all possess.



SIX STAGES IN A SEASON'S GROWTH OF THE RED DEER'S ANTLERS

If we can conceive a sort of explanation of the change of colour in the Arctic animals, we can scarcely apply the same explanation to the change which comes over such creatures as, let us say, the British roebuck. This little beauty is of as gay a red as a fox in summer, but when winter days draw near, lo! the red vanishes, and in its place appears a sober, fawny grey, with the remarkable addition of a big white patch of hair upon the hind quarters of the buck. And this leads us from the tailor's to the armourer's, for we must now consider the crowning wonder of the winter change in animal life. In summer a red stag, or a wapiti, might be mistaken for one of the does, for it has no antlers. On its forehead are two bony knobs—that is all. The stag roams, peaceful and quiet, with other stags, as harmless as a kid. But it withdraws very much from observation, and hides in the privacy of unfrequented glades, where one of the miracles of Nature takes place. From those two bony ridges on the stag's forehead there presently appear the beginning of antlers. Then follows an astounding growth. Great arteries pass up through the bony ridges, and from that blood-supply the stag builds up bone, which grows as rapidly as the branches of a well-nourished tree. The bone grows into massive characteristic form, with a mighty trunk and fine branching points, until the antlers are completely matured.

For the first year or so the antlers are small, but with each successive year the growth is larger and the points more numerous. At a definite stage every year, however, the growth ceases. The bony ring from which the antler springs tightens and hardens, closing up into a solid mass, so that no further supply of blood can reach the antler. The antler at that stage is covered with a fine velvety skin, which, up to that point, is alive with nerves and vessels, and will bleed and cause the stag pain if it is scratched. But when the growth is complete this velvety sheath dries up; the stag rubs its antlers against the trees and strips off its velvet.

A HERD OF RED DEER, WITH ANTLERED STAGS

And then, when winter's footsteps are approaching, the stag, a mighty, antlered prince of beauty, steps forth, "belling" and roaring, from the shade into the open, to find and do battle for a mate. Throughout the winter it carries its towering antlers—seventy pounds weight, perhaps, of dead bone. For the antlers *are* dead from the time the ring of bone closes and shuts off the blood-supply. There is no more life in the antlers from this point than in the steel armour in which knights of old went forth to battle.

The antlers serve for battle, as weapons of offence and defence; but they are not for that alone. They serve as a means of gathering food. When times are hard the lordly stag uses his spear and lance and his battering-ram—for such the antlers are—as tools with which to gather his daily bread. Rising on his hind legs, or springing high into the air, he dashes his antlers into the trees above him to shake down the berries or other fruits which they still bear. All through the winter he carries this mass of dead bone, as a strong weapon of defence; looking, in his proud carriage, like the king of all wild animals. Spring comes, and his mate is by this time safe from harm. The stag retires again to solitude and lays aside his armour. Every year he sheds those mighty antlers, and again assumes the hind-like form in which, throughout the summer, we are wont to see him.

His is the greatest of all the winter changes, the greatest and most surprising to most of us, for so few have the delight of seeing deer, which are all confined in parks, or dwell in distant forests beyond our reach.

But that is what happens. Every male deer in the world makes these changes year by year, from birth to death.

It is not so with hollow-horned animals—the cattle, the sheep, the goats, the antelopes, and the giraffes. The horns of most of these have soft, bony cores, with a horny sheath as covering; and horns are never naturally shed. But the antlers of the deer are quite different. They are solid bone, grown at an incredible rate, and shed, when their purpose is served, even more swiftly than they are grown. When we see antlers lying in a forest or a park, therefore, let us not assume that a deer has died to make the sacrifice. We see in those fallen antlers the last page of a chapter in the story of the magic armour and vestment which Nature gives her children for the cold days of winter.

THE ICE BREAKING UP OFF THE COAST OF LABRADOR

SPRING COMES TO WAKE UP THE SLEEPERS

THE WAKING-UP OF THE GARDEN WITH THE COMING OF THE WARM SUN IN EARLY SPRING

RIP VAN WINKLE WIDE AWAKE

THE NOISE AND BUSTLE IN THE CORNERS OF THE GARDEN AND THE PROCESSION FROM THE WINTER HIDING-PLACES

THE GREAT SLEEP THROUGH THE LONG WINTER'S NIGHT

THE days of early springtime are the gayest, loveliest, and most wonderful of the year. Spring is the daughter of Winter and the mother of Summer. She receives from her parent a cold and sleeping world; she hands on to her daughter a world teeming with life and beauty. Flowers have sprung up at her bidding; blossoms bedeck the boughs; the grain is leaping up as if it would brush the sky; the tall trees are shaking joyous garlands at the radiant sun. But there is another resurrection in progress all about us.

We watch with bated breath as a conjurer seems to bring something out of nothing, but Nature is the greatest conjurer of all. A man takes a hat and drags ribbons and flags and flowers from it, and tells us as he does so that "the quickness of the hand deceives the eye." But Nature takes a deserted garden or field, a quiet, still, unpeopled countryside, and fills it with crowded, hurrying *life*. Watch for an hour in the garden, and you will see the miracle taking shape before your eyes. In the blustering month of March we see life stealing out from the back of somewhere, life which has been missing through the dark, chill months of the long winter.

The slugs are out from their hiding; the snails have taken down the shutters that bar the entrance to their dwellings; the frogs are shouting from every pond and ditch; the bat launches himself into the air at nights; and the field mice hasten from their hiding when the daylight no longer dazzles their beady eyes. The badger is astir in the woods; the squirrel no longer sleeps a week at a time; and Master Woodchuck quits his deep underground burrow and comes back to rejoice in the meadow.

A little while ago there was not a suggestion of life to be seen, save where the birds bustled busily about the lawn or borders. But now a magic wand has been waved over the face of the earth, and, lo! living forms start up about us at every turn.

We can fancy them rubbing their sleepy eyes and saying to themselves: "Whatever can have happened since last night?" When they went to sleep the trees were shedding their foliage, here and there a few apples remained unpicked upon the trees, and the last of the autumn plants were still struggling wearily with the wind and rain. But now all is changed. The trees are in bud, the catkins are green and gay upon the branches, and the birds, which were then as dumb as ditchwater, are singing a new song.

What *can* have happened since they went to sleep last night? Well, what has happened is that the night has been five or six or seven months long, and they are little Rip Van Winkles. Rip Van Winkle went to sleep for many years; our little friends have slept only for months, but since they fell asleep in their snug hiding-places, expecting to wake as usual in the morning, the world has turned round and round. The last shreds of autumn have been blown away by the winds of winter; the storms and tempests of winter have been abroad in the land; frost has made the earth like iron, snow has made it white as down; and now spring has driven the frowns from angry skies, and has pierced the clouds so that the sun may peep through and call all sleeping things to life and work.

Winter has not been a season of death for these little creatures of the garden, the hedgerow, and the field. It never is. It is a time of rest, forgetfulness, and safety.

But there seems a miracle in it all. Tiny insects, fragile as the eggs from which they came, have, like the burly armoured hedgehog, passed winter days and nights without food or drink; bats, which are simply winged animals, feeding their little ones with milk as a cat feeds her kittens, have passed the winter in the same way; the tiny dormouse, daintiest of all his tribe, and the long-tailed field-mouse have been fast asleep in their hiding-places, and with them have slept the toad in his muddy retreat, the frog in the mud at the bottom of his pond, the baby spider in its silken cradle.

Some of these little creatures, wakened by an exceptionally warm day of winter, may have stirred forth in search of food, but they need not do so. They are so marvellously guarded by Nature that, for all the winter months, they can defy time and cold and hunger. It is not the cold that sends them into their winter sleep. That, of course, has a strong, indirect effect. The direct cause is the cutting off of food supplies. Towards the end of the year insects become scarce. The food supplies of the insects vanish with the passing of autumn, and the insects vanish with them. Either they go into their winter sleep—or hibernate, as we say—or, as is more often the case, the adult insects die, leaving behind them either eggs or larvæ, which may be in the caterpillar form, or in the chrysalis form, or in strange garb such as the dragon-fly's baby wears before he throws off his worm-like disguise and dons his livery of shining mail.

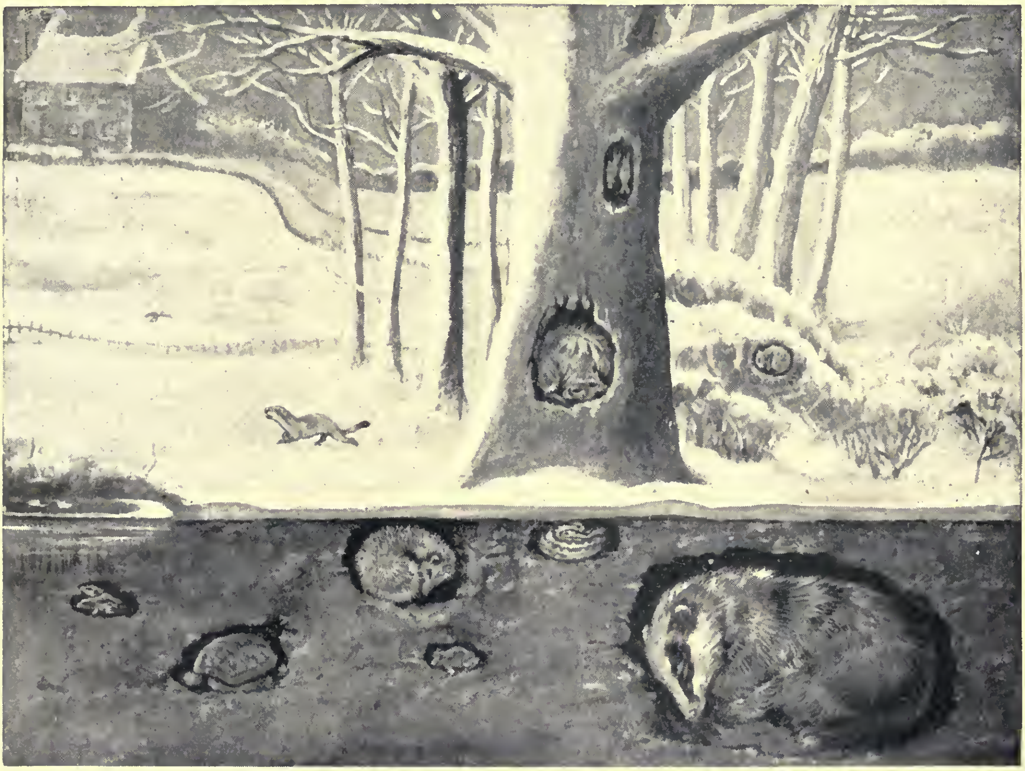
THE FROGS TALK OVER THEIR WINTER DREAMS

Now, when the insects disappear, there is no food for the animals that depend upon insects for food. Flies and gnats and midges are dead or hiding; the snails and slugs have gone into retreat; the worms have tunnelled deep below the frost-line, and are coiled up like tiny, living figures of eight, far down in the soil, where only the powerful moles and active shrews can reach them. The food of the field-mouse and the dormouse is cut off by the scythe of winter; there are no worms or beetles or moths for the frogs and toads; there is no tender herbage for snail or slug, no nectar for butterflies or moths.

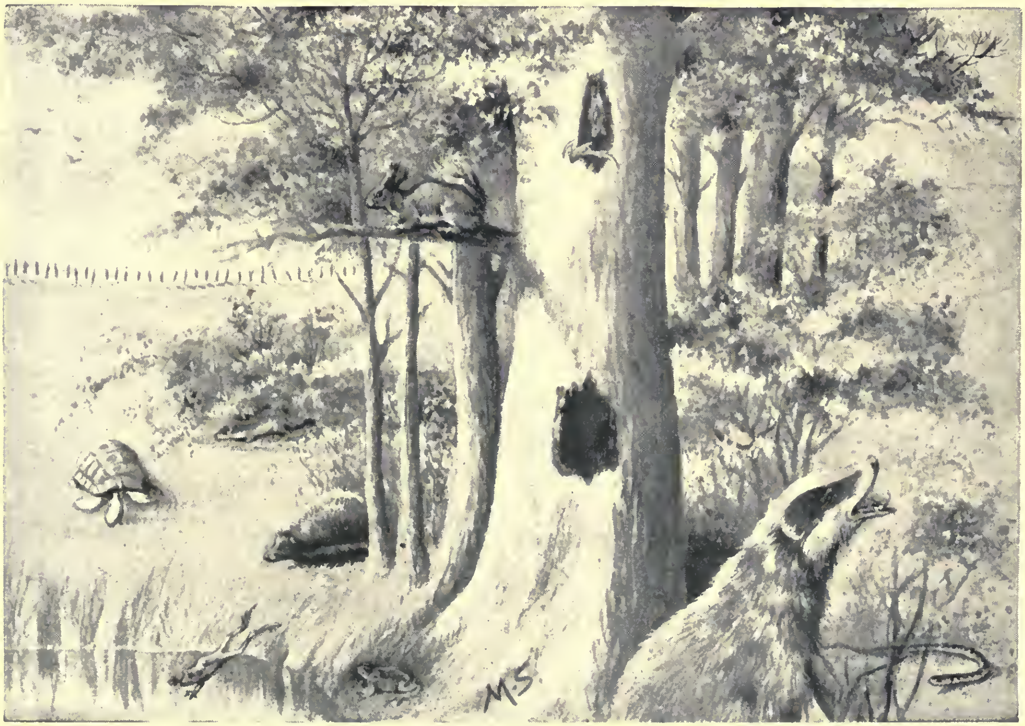
If the food of human beings suddenly disappeared we should all die, but we have brains enabling us to make provision in advance; few of the animals have. For them it matters only that spring and summer come, bringing food in abundance. In the early part of the year they eat to meet their bodily needs. As summer advances they eat more than is necessary for this purpose, and the excess goes to build up a great reserve of fat in the body. Then, without any calendar to help them, they slowly prepare for the Great Sleep. We see it stated sometimes that hibernating animals are stupid, that they go to sleep when food is still abundant. But Nature does not plan for a year, she plans for hundreds of centuries. When we find the bats and hedgehogs taking up positions in their winter quarters, we may know that they have come to the time which, on the average, witnesses a shortage in food. It would be fatal for them to wait indefinitely for the last few meals to round off their fatness. Unless they have stored up a certain reserve of strength within a given time, they cannot hibernate, but must keep on the trot, seeking to make up for the nourishment they have failed to acquire in advance. That may mean death, for while they are still seeking extra food their supplies are hourly growing less and less.

And so Nature has taught these little creatures to be ready by a certain date for their long sleep, and they are wise enough to do their part, leaving Nature to do the rest. If the weather continues evenly cold, they may pass the entire winter without once waking. If it should prove a mild winter, some of them may be warmed into coming out to see what is stirring. But they soon cuddle down again in the bed they have chosen—yes, *chosen*, for they must choose their site wisely, where the temperature will not greatly vary, for if they should be where the cold can easily reach them, a rapid drop in temperature will awaken them from their sleep, and they may die. This seems a marvellous provision of Nature. Human beings die in the presence of overpowering cold, but the same cause wakens the sleeping animals, and warns them to take better care of themselves. And while

HOW THE ANIMALS SLEEP THROUGH THE WINTER



AN IMAGINARY SCENE UNDER THE GROUND, SHOWING THE ANIMALS IN THEIR WINTER BEDS



THE ANIMALS WIDE AWAKE WITH THE COMING OF THE APRIL SUN we have wondered why the garden and fields around seemed so lifeless all the winter days, thinking, perhaps, that our little wild friends were dead, this mysterious process of Nature has been going on, not, indeed, before our eyes, but well within reach of those who know where to track the little sleepers to their beds.

A GARDEN SNAIL, WAKING UP FROM HIS LONG SLEEP, CREEPS OUT TO CALL HIS NEIGHBOUR

It is over now, until the end of next autumn, and, having had their long sleep, our friends are about again, active, hungry, busy as a bee. During the winter there have been comparatively few wasps in existence. Only the queen wasps live through the winter; the workers die in the autumn. The queens are active now, laying the foundations of the nests in which they will lay their eggs. The queens have been torpid all the winter, but spring has called them back to life and duty. The little bundles of golden balls that we see clutched up together in the wonderful webs are the children of the great garden spider which we watched at work last summer. She is dead, but these are her babies. They have all nestled snug and warm together in their cosy cradle throughout the winter, and have eaten nothing. Now they will begin to scatter from the nest and seek their living prey.

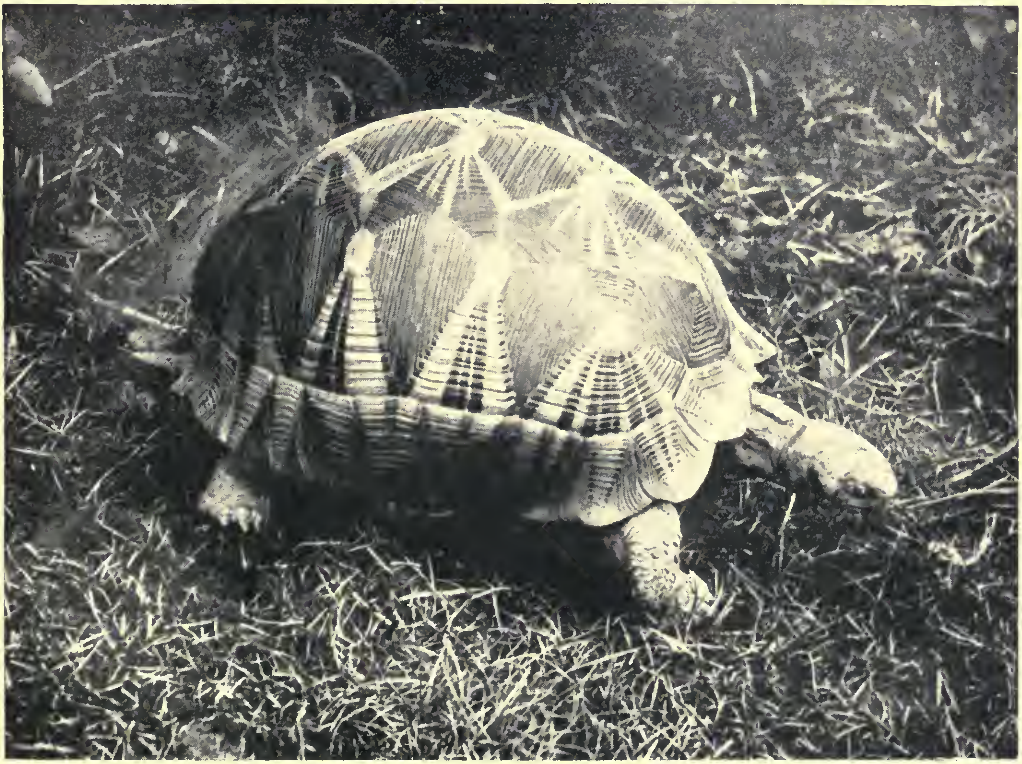
A GROWN-UP SLUG OF THE GARDEN, WITH THE EGGS OF A SLUG AND A SLUG-BABY ONE DAY OLD

Life is springing into being in the ponds and ditches, where for all these months fish have lain half buried in the mud, where the larvæ of water insects have slept, where the frogs have dozed, without eating or drinking, without even breathing. Now the frogs are up and out, the liveliest, noisiest creatures in the world. They are making their nurseries. The females are laying their eggs, and the males are bustling about in the water, pompous, noisy, important as a country fireman the first time he puts on his brass helmet. They do not bother about food; meals can wait. They are much too anxious to show off their swimming powers, to exercise their voices, and shake the air with their croakings. Really, a frog's song is not nearly as charming as a nightingale's, but the frog does not believe that. His gurgling croak, which just now goes on day and night, is like the bouncing rattle of a lot of peas in a big bass drum, and to produce it he has enlarged his vocal organs, and the pouch under his throat from which the sound is produced has turned pure white. When the eggs are all safe, the frogs will climb out of the water and take to the land, by which time the slugs will have backed out of the holes in the soil where, encased in a sort of cocoon of glistening slime, they have lain since the last days of last autumn.

And that master-builder of the lowly world, the old snail, has unbarred his door.

TWO GENTLEMEN WHO LOVE A LONG NAP

THE EUROPEAN HEDGEHOG, WITH ITS PRICKLY COAT, WHICH SLEEPS THROUGH THE WINTER AND WANDERS OUT ON SUMMER NIGHTS IN SEARCH OF INSECTS



THE UNGAINLY TORTOISE, WITH THE BEAUTIFUL SHELL, FRESH FROM THE BURROW IN WHICH IT HAS SLEPT THROUGH THE WINTER

Every autumn he erects across his portal a solid horny barrier, with only a little opening to admit air for him to breathe, and behind that barrier he is as safe and snug as a baron in his castle. He is, in many ways, a wonderful fellow, perhaps the first creature in the world to understand the meaning of friction, and to master it. When we wish to stop a motor-car we put on the brake, which means that we make the wheels rub the surface of the road and slowly bring the vehicle to a standstill. But if the roads are greasy the car may slide and skid, because the grease lessens friction by preventing the wheels from biting, as we say, and it is to lessen friction—and increase speed—that we oil the wheels of carts and motor-cars and trains. Well, the snail has to drag itself upon a long, extended foot over rough ground, over which it is very difficult to travel. To meet this difficulty the snail has a gland in the front part of its muscular foot, and from this gland a slimy fluid is poured as it crawls, making the ground slippery and easily passed by the snail's entire body. The silvery tracks on the garden paths in the morning are the wonderful roads which the snail has made in the night upon its homeward way.

THE PEACOCK BUTTERFLY DRIES ITS WINGS AND PREPARES FOR FLIGHT

It should not be difficult to track snails to their hiding-places, for they seem to have as great a love for home as birds, and, no matter how far they travel in search of food, they seem always to return to the same spot to sleep.

The movements of snails and slugs at best are slow—fast considering the way they have to travel, perhaps, but slow compared with the pace of their enemies, which, now awakened from slumber, are out in quest of them. There is this to be said for the snail, that if it is slow it is sure, and marvellously skilful, too. Could you walk barefooted across the sharp edge of a razor-blade? A snail can. A French scientist has put a snail to the test. The snail could not escape except by climbing up one side of the razor-blade, across the terrible edge, and down the other side. Snails are not used to crossing razor-blades, but this one knew exactly what to do. Climbing up the side of the blade, it obtained a good firm grip, arched its body, and put the fore part of its elastic foot on the opposite side of the blade. Then, still arching its body, it drew itself up from the back, and thrust itself forward at the front, without pressing in the least upon the edge of the blade. So the snail crossed uncut over the razor's edge.

The snails and slugs, thin and hungry after their long winter sleep, work havoc among the gardener's early growths. But there are various policemen looking out for the thieves. Apart from the birds, which snap up slugs and swallow them at a gulp, and crack the shells of snails against big stones, there are four-footed friends of the gardener to keep watch upon the slippery foe. The frogs and toads are always looking out for slugs, though the shells of snails are too much for them. But a slug is a tit-bit. An English writer had a pet frog in a greenhouse. It would come to a certain spot each night, where he would feed it. One night he put down a slug, seven or eight inches away from the frog, and turned a light upon it. The frog watched the slug intently for a minute—for frogs will eat only living food, and will not believe a creature is alive unless it moves. After a minute the slug began to crawl away, and in an instant the frog was flying through the air in pursuit. As it descended it stretched forth its head as far as it could, flung out its long, sticky tongue, whipped up the slug, and, as it touched the ground again, had the dainty morsel safe. Of hundreds of meals the writer had given to frogs and toads, this was the first time he had seen one taken with a quickness like a bird's, But there are other searchers for slugs and worms, and for frogs too. The hedgehogs are among them. This is the prickly animal whose portrait is given in this article. It is European. No hedgehogs live in North America. The hedgehog is called an insect-eating animal, but that is a rather misleading description if it is accepted as meaning that the hedgehog eats insects only. The meaning is that the hedgehog has teeth and general outlines resembling that of the class of animals which do subsist on insects. It is hard to make a pet of a hedgehog, because it is so prickly that, even if you put on thick leather gloves to handle it, the movable spines penetrate the leather and run into the hand. Still, it can be done, as a story will show.

It began with a cat and a rat. The cat chased a rat, which ran under the boarded floor of an old tool-shed. The cat's master pulled up a board or two of the floor to enable the cat to continue the chase, and there, snug as kittens in a basket, lay a mother hedgehog and her five babies. The finder, knowing that a friend was interested in hedgehogs, took up the family, put them in a basket, and presented them to him. Such excitement there was when their new friend put the six out on the floor of the study! The mother was afraid, not for herself, but for the safety of her little ones. One by one she took them up in her mouth and sought dark places to hide them in. Back in the basket of hay with her little ones, she remained at peace for that night and the next day, well supplied with food and milk. Then she was put in a packing-case filled with hay, far away in a quiet summer-house. The box was turned on its side so that she could come and go, and a good supply of food was left.

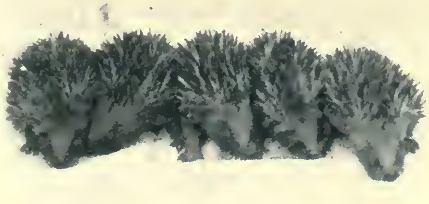
The next morning, when her friend went to look for her, he heard a most dismal squeaking. The babies were piping away with tremendous vigour. The mystery was soon solved. Their mother had left them; they were orphans. Hedgehogs must hide, under roots or among heaps of leaves; they do not like daylight, and cannot at first tolerate the hutch. So the mother had wandered off at daylight, afraid, no doubt, of the conspicuous retreat provided for her in the glare of the sun. The little ones were trembling with cold and desperately hungry, so their friend now became father and mother and nurse to them, for he could not see them die. He tried to feed them with milk from a spoon, but the little creatures screamed all the louder, and refused the meal he offered. This was worrying, but presently a thought struck him. "How foolish to offer them cold milk! Of course, they have never tasted anything cold." So he had some milk warmed, and tried again, this time with perfect success. They drank

HOW THEY SPEND THE WINTER HOW THEY SPEND THE SUMMER

On the left is a mass of caterpillars of the lappet moths: on the right the moths are flying about in the summer sun.

the milk greedily, and soon became warm again. Their box was left in the summer-house in case the mother should return, and again and again the friend of the hedgehogs went down to see if she had got back. He paid his last visit at a quarter-past eight at night, and, carefully examining the hay in the box, found she had not returned. Then he made up his mind that he would have to bring up the prickly little babies by hand —which, seeing that there were five of them, was rather a labour for a mere man. Still, he took them to the house, and at nine o'clock, when it was quite dark, he set out to fetch the box to make them snug for the night. But as he approached the summer-house he saw, by the light of an electric lamp, something moving on the lawn. It was a big hedgehog, scuttering away for the bushes of one of the borders. He dashed after it, caught it among the shrubs, took it to the box, and then carried it in the box to the little hedgehogs in the house. On the hay in the box he put the babies, while the big hedgehog he placed near, to see what would happen. The babies, appearing to realise the presence of a protector, showed evident signs of pleasure. But the newcomer would have nothing to do with them, and tried to tunnel under the hay.

THE MOTHER HEDGEHOG ASLEEP WITH HER CHILDREN



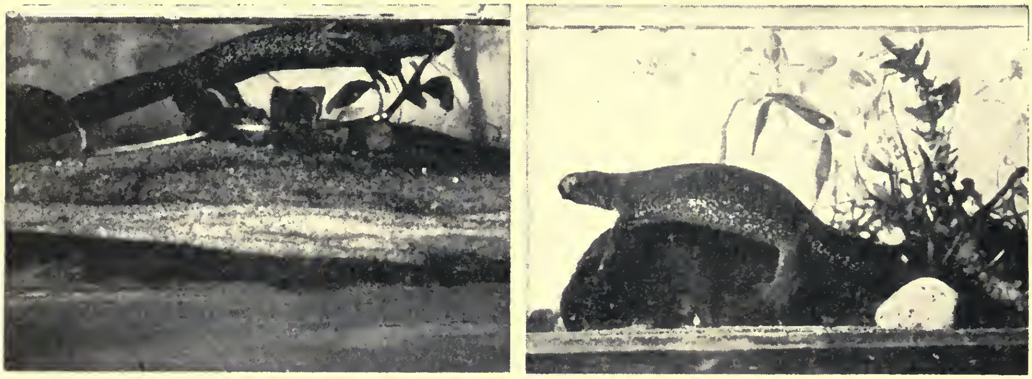
"WE ARE FIVE"

Then a strange discovery was made, for the disturbing of the hay revealed the fact that there were two big hedgehogs there! The one just caught on the lawn was not the mother, who lay concealed in the hay in the box. The faithful creature, as soon as darkness fell, had returned to seek her babies, only to find them gone; and there she remained, perhaps mourning for them. She had never been in that place before, yet, being absent from her little ones for a day, she had remembered, and found her way back to where she left them. Of course, they would have been dead of cold and hunger had they not been cared for, but it was not easy to avoid the feeling that the mother hedgehog had missed her little ones and come back to them, grieving to find them gone. The strange hedgehog was at once carried out on to the lawn, and the mother was left with her children. Her joy at finding them again was quite delightful to see. She gathered them about her with the affection of a hen for her chickens. Three she drew to her body, the fourth she tenderly held with one of her forepaws, the fifth she took in her mouth, gently mumbling it over with a low crooning of content.

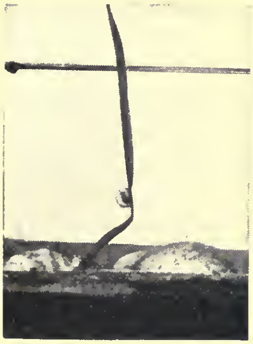
THE MOTHER HEDGEHOG WATCHING OVER HER CHILDREN

Perhaps you may be interested to know what she had for supper. First she had a dish of roast beef and milk, and after that about forty slugs, about twenty cockroaches, and several worms, woodlice, and moths. She did not eat all these at once, but cleared up the whole in the course of the night; and she was fed in that way for about three

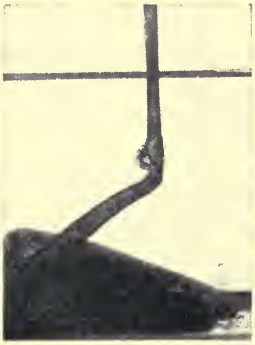
TWELVE SCENES IN THE LIFE OF A NEWT



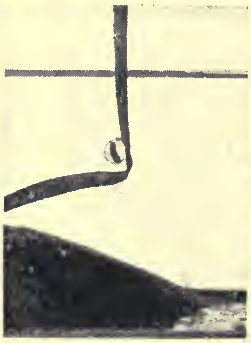
THE NEWT FOLDS UP A LEAF WITH HER HIND LEGS, PLACES IN IT AN EGG, AND DEPARTS



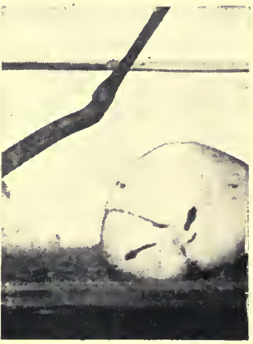
EGG TWO WEEKS OLD



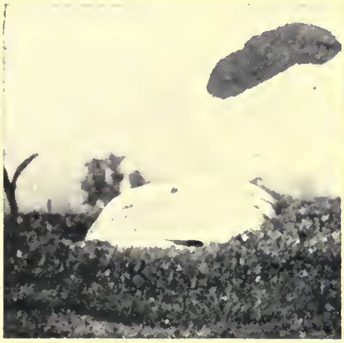
DAY BEFORE EMERGING



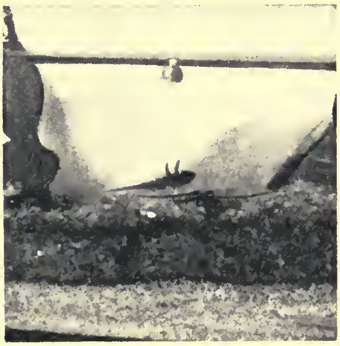
A MINUTE BEFORE EMERGING



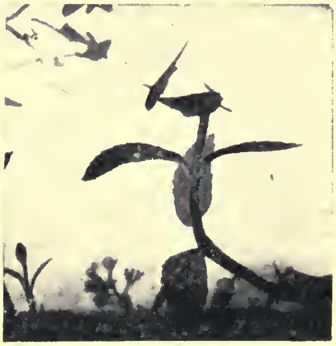
THE GREAT DAY



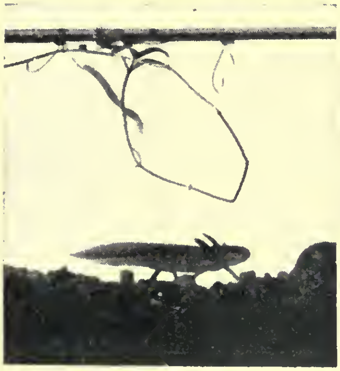
THE NEWT TWO DAYS OLD



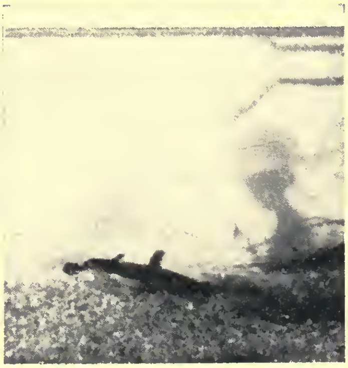
THE NEWT AND ITS FRIENDS



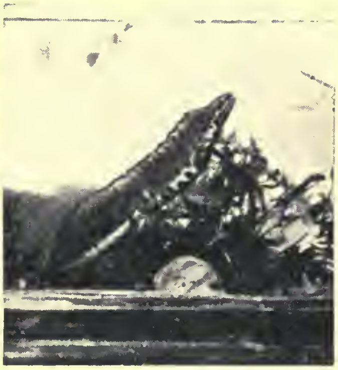
THE NEWT TWO WEEKS OLD



THE NEWT SIX WEEKS OLD



SWALLOWING A YOUNGER NEWT,



AND GROWN TO FULL SIZE

weeks. In that time the blunt, wedge-shaped little snouts of the babies assumed the true, pointed, pig-like outline of their kind; their eyes opened, and they grew more active, more pretty, and more impossible to handle day by day. But both she and they became quite friendly. Their instinct, when touched, was to curl up like a woodlouse, leaving only a barrier of prickles facing in all directions; but they became in time quite tame and fearless, and sat for their portraits like good children.

It is comforting to the European when he sees the hedgehog come out from its hiding and renew its business pursuits—that where these animals are present he need not go in fear of the snakes which the sunlight of March brings from their retreats. In England only one snake is to be feared, and that is the viper. The viper is a venomous creature, whose bite may kill a child, and make a grown-up very ill. It lives on mice, small birds, frogs, and other little animals, killing them with the deadly poison flowing from its fangs, and then swallowing them entire. In winter the vipers, like other snakes, collect in large numbers to hibernate, and cluster together under the roots of trees or elsewhere, a tangled mass of evil. It is curious that the young viper, the moment it quits the egg, will raise its head and try to bite the hand placed near it. Vipers frequent heaths and waste places, and are found among brushwood and stones, but spread wherever their food supply may lead. One, measuring over two feet, was brought to a museum last year after it had been caught in a Kent nursery garden. Seeing that these fearsome reptiles travel far, it is good to have a hedgehog or two in the garden. The hedgehog and the snake wake up at about the same time, and the hedgehog will act as policeman to guard against the reptile, upon which it delights to feed, feeling not the least ill-effect from the poison of its fangs.

THE BADGER COMES OUT OF ITS BURROW
From a photograph by Mr. Douglas English.

Another little animal which now comes out to make up for lost time is the squirrel. Squirrels cannot be said to hibernate as do some of the other animals of which we have been thinking, but they sleep away short spells of bad weather, and only when they are very hungry indeed do they creep out of their little homes, to pop down the tree, dig up a nice fat acorn or two, and scamper back to bed. The powerful badger of the West undergoes a sort of partial hibernation in the coldest weather, too, lying snug asleep in his fortress under the earth until milder weather, or a severe attack of appetite, drives him out above ground. But these two examples do not represent real hibernation. The hibernating animals, when in their winter sleep, can be dropped into water or chambers of poisonous gas without the least ill-effect. Their little hearts go on slowly beating. That is apparently the only part of them alive. The heart works on, driving the blood slowly through the circulatory system, but all other organs are at rest, and the body lives upon the store of fat which the animal builds up on the approach of winter.

But does a butterfly lay up a store of food? That we cannot say. Yet it is true that certain butterflies hibernate. Vanessa butterflies come sailing into the sun on a gentle winter's day. They are not newly hatched, as at first we are apt to think. They are lovely reminders of last summer which have managed to find a snug, sheltered retreat, safe from the nip of frost and violence of winds; and when the sun has won his battle with the clouds, and is able to lavish his kindly smiles upon the earth, out they flit, like dancing poetry.

If the tender butterfly can survive, we need not wonder that the aged tortoise, with his massive fortress of horny mail, should manage to live, too, in the hole he excavates with his sharp-clawed feet. So in spring the tortoises come creeping out from their beds, with all the other creatures of the garden that have shared their rest. It is the end of the Great Sleep and the beginning of new life; and soon the garden will be itself again, all its little people wide awake.

A TALL GENTLEMAN OF AFRICA

FROM MORNING TILL NIGHT WITH A GIRAFFE

IF animals were to boast, as human beings sometimes do, we might hear the elephant and the whale declare that they are the biggest animals in all the world. That would be true. Then the rhinoceros might claim to be a good second, and that also would be true; but the hippopotamus would be justified in adding, " What the rhinoceros says may be correct if you consider only size; but if you consider weight, then I come next to the elephant." And then we might hear a protest from the giraffe: " That is all very well, but you are a lot of stumpy fellows, when all is said concerning weight and mass. Now, when you come to the question of lordly height you are all dwarfs. Look at me, I am half as tall again as the tallest elephant that you can find. Consider that, and keep your places with more modesty."

And no animal would be able to deny that, for the giraffe is the tallest of all living creatures. To find a rival to him we should have to set a great snake up on end; but that would not be fair, for the serpent is a wriggler and a glider; the giraffe is a swift-running animal, which could bound away from us as easily as a man can outpace a child. What do we know about this strange creature? We will follow him, in imagination, during a day of his life.

We may find him on the grassy, tree-dotted plains of Africa, where he has ostriches and zebras, and perhaps an elephant or two and a rhinoceros, for company. But that happens less frequently now than once upon a time, for cruel hunters have so persecuted him that the giraffe now generally makes his home in or near desert places. We seek him, then, in surroundings which would be impossible to human beings—amid wild jungle scrub. It would be no use our looking for him in a forest, for in order to get there he would have to leave his long neck behind him. Our giraffe is the lord of a herd of giraffes. A herd may number from five to fifteen, or even more; and our leader, a fine, stalwart male, has fought for the leadership and beaten off his rivals. He pilots his family to food, and watches for enemies.

Away out over the plain he goes, and as he paces gently along we think at first sight that his front legs are longer than his hind legs, for his shoulders are much higher than his hind quarters. But as we are students, and not fierce, thoughtless hunters, we have time to observe the details of the animal, and we find that the great height of the shoulders is due to the remarkable length of the bones which we call the shoulder-blades, and we note that the long legs and the shape of the shoulders and neck are simply part of the plan upon which the giraffe is built—to get his handsome head as near the clouds as possible.

Now, what food can be got so high up there, where it would seem that only birds can find nourishment? We see a clump of tall trees in the distance, and our giraffe leads the way to them, and the mystery of his extraordinary neck is explained. The tree is tall, and the foliage upon it is high up, with the newest and tenderest verdure at the top. The giraffe, on reaching the tree, thrusts his long neck among the branches, and extends his head so that it is stretched out in a line with his neck, not kept at an angle as is the head of a horse feeding from a manger. Our giraffe is already eighteen feet high—three times the height of a tall man—but this bending outwards of the head gives him a further height.

The tree upon which he is feeding is an acacia, a tree famed for its armour of prickles. But our giraffe, with his tender palate, does not touch the thorns. The upper lip is flexible, and with it he can draw into his mouth the leaves nearest his teeth. But that is not all. There are leaves beyond the reach of even that long neck and that flexible upper lip. He shoots out his tongue, the most wonderful tongue possessed by any of the big animals. It measures from 17 to 18 inches as it lies in the giraffe's mouth, but he can stretch it out as if it were made of elastic. It is a surprise to see a small chameleon suddenly shoot out a great expanse of tongue to catch an insect; but this giraffe's tongue is like a long ribbon. It is to our long-necked friend as the trunk is to the elephant. It is his hand! With the tip of his tongue he can reach leaves to get which we should need a ladder. And he crops them with it as neatly as a sheep crops grass with its teeth; picks them off, one by one, as nattily as an elephant nips off tender shoots with his trunk.

A dainty gentleman is our giraffe; he selects only the youngest and tenderest leaves. The tough and withering leaves he disregards. So he makes his meal. But though he is busy with his head in the tree-tops, he smells and sees water. Now, when he is right away in the desert he can go for months without drinking, but there is no need for that now, so he moves off to the pool to drink.

But the difficulty of the fox and the grapes was no greater than that of our giraffe with the water. The fox found the grapes too high, our giraffe finds the water too low. That lofty neck of his is not long enough to reach down to the ground by ordinary means. The giraffe, however, has not been living all through the ages without learning wisdom. He straddles his front legs apart, and lowers his head. No, that will not do; he is not yet low enough. He gives himself a jerk, and stretches his legs still farther apart. Again and again he has to make these funny little jerks, and at last he is able to bring his lips to the water, and take a deep and welcome draught.

A GIRAFFE OUT WALKING

It is a cloudy day, and lions are on the move, and suddenly a lion springs out to seek a feast. But the giraffe, though he would be helpless if the lion once fastened its terrible talons in his shoulders, is a match for the mighty cat when on his guard, and suddenly the great creature becomes a warrior, battling for life. Those delicate-looking hind legs of his become converted into battering-rams. Bang, bang! crash, crash! they go.

It is not like the kick of a horse or donkey—one or two good kicks, and then no more. The blows from the giraffe's hind legs come like a succession of piston strokes, and the lion, who knows their terrible force and rapidity, slinks away foiled. Our giraffe then trots off to rejoin his family, who have retreated to a place of safety while their valiant leader has settled accounts with the lion.

But what is this advancing at great speed across the plain? It is the giraffe's other mortal enemy, a human hunter, mounted upon a fleet horse. This is a foe more to be feared than the lion. Away goes our friend, swinging off in a lumbering sort of speedy gallop, with his little herd around him. The huntsman is a wily fellow. He knows that a giraffe, if allowed to gallop at its own pace over a rough surface, can outrun the best of horses, but that if forced to put forth its highest pace at the start, becomes overtaxed and flurried, and may be eventually overtaken.

So on the man comes at his horse's swiftest pace. It is a terrible moment; but the giraffes have a start, and they kick up such a cloud of dust as they gallop over the dry ground that the man cannot get a shot at them. Our leader heads for a patch upon the horizon clothed with wild scrubby undergrowth, not tall enough to catch his own neck, but tall enough to be a serious hindrance to the man and his horse. The dust is a cloud of security to the giraffes, and they reach the scrub unharmed, but with the man terribly near them.

He draws near to the leader; but his horse, he knows, is afraid of fire, so he must dismount if he is to shoot. The giraffe and his family crash through the undergrowth. The prickly branches make no impression upon their stout coats; but as the thorny obstructions, thus brushed aside, spring back they threaten to sweep the horseman from his saddle, and perhaps to blind him and his horse. He is compelled to pull up; the advantage which he has gained by the greater speed of his horse is thus wasted, and the giraffes, pressing on, soon get so far away that shooting is out of all question.

A BABY GIRAFFE HAVING A REST

Then the wise and valiant leader brings his family to a part of the jungle in which the trees, while not numerous enough to form a forest, are enough in number to enable the herd to hide by simply standing still. So perfectly do their spotted coats harmonise with the broken light amid the trees that the hunter, working discontentedly along, actually rides past, and does not see them. What we call the protective colour of the giraffe has completed the success of the flight for life which depended at first upon speed.

The perils of the day are over. The giraffe, when his sides have ceased to heave and his heart to throb, conducts his family to a feeding-ground where they may be secure; but still he keeps careful watch for lions and men. Even while he is feeding he faces in the direction from which the wind blows, so that he shall be warned by scent, as well as by quick hearing and his splendid sight, of the coming of any foes, human or animal.

The tall gentleman out walking, and the baby giraffe resting at his ease, of the pictures, are not at large in the jungle, but are housed at the zoological gardens, where we may study them at our ease, and where, instead of hunting them down, men care for them and keep them in safety. Still, if they had their choice, it is likely that our friends at the zoo would take the freedom of the jungle rather than the safety of captivity. The giraffe, you will notice, has funny horns, which are not, as in the case of his cousins of the deer family and the ox family, made of the substance we call horn, but are covered all the way up with skin. That is why, as we have seen, he depends on his heels as weapons of defence. Some of the giraffes who live toward the north of Africa have three of these queer little horns, one of them being placed farther down, in front of the others

THE BROWN BEAR OF THE SNOWS SETS OUT IN SEARCH OF A WINTER HOME

IN THE COLDER COUNTRIES THE BROWN BEAR SLEEPS THROUGH THE LONG, DARK WINTER AND GOES OUT, WHEN SNOW COMES, IN SEARCH OF A WARM WINTER HOME

This picture is the copyright of the Berlin Photographic Company

WHERE ARE THE BEARS?

THE GREAT ANIMAL RIDDLE WHICH COMES UP EVERY YEAR FOR NATURE'S FRIENDS TO ANSWER

THE STRANGE DISAPPEARANCE OF A WILD FAMILY

WHERE are the bears? is the great puzzle Dame Nature sets for her friends to solve in the winter season. If we care to walk about the cold lands of the world then, where not long before the bears were prowling about in great numbers, we should meet hardly a single mother bear, and we should have to search long and closely before we found any bears at all. Where the father Polar bear and his children may be we do not know, but we can answer the riddle for his wife, and for the rest of the great bear family. They are fast asleep under the snow, and the world that knows them well at other times knows them no more—till they awake, and return in greater numbers still.

The traveller in cold lands in winter might think there were no bears, but the truth is that, in spite of the cruel persistence with which men hunt them, bears are among the most numerous of all the big animals. But at this season of the year it is impossible to find most of them. The simple fact is that in the cold parts of the lands in which they live—but not in the warm lands—they tuck themselves up in bed in the autumn, fall into a deep sleep, and do not wake up again until the snows are melting or have vanished. They do what no other large animal in the world can do—sleep away the winter, living on the great stores of fat they have managed to accumulate in their huge bodies by diligent hunting. They snooze away the cold, dark months as snugly as a fat dormouse in its winter retreat. Three, four, five months or more may pass in this way, with not a particle of food eaten.

At the end of that time Bruin wakes, stretches himself, feels hungry, and sets out in search of food. He went to bed as fat as butter; he has lived upon his fat and comes forth lean, with his coat shaggy and baggy, and in a very bad temper. He is in a desperate hurry to get food to make up for the long fast. What shall he eat? Practically anything. Suppose our bear to be one of that brown species which cruel men lead about the streets. That brown bear ranges over many parts of Europe, eastward to India, and through Siberia and other parts of Asia.

When he comes out from his winter quarters he will eat buds, berries, grass, leaves, fruit, and honey, grazing like a cow, climbing like a great stiff-jointed monkey. He will pull huge stones aside with his great paws and dig out and eat the insects lying below. He will kill and eat a deer, or a horse, or a cow, or any other animal that may tempt him and come within his reach.

He will kill a man, but not if he can possibly avoid a conflict. If we were suddenly to meet him face to face, in a trap from which he could not escape, he would probably kill us, but he would not hug us to death, as many people believe. Bears do not hug. That is one of the old mistakes. They have the most terrible claws in the world, and with them they strike what boy cricketers call a " round arm " blow. The fearful claws are driven through clothing and deep into the flesh, and in the grip in which the bear holds his victim while inflicting a bite there does seem a suggestion of hugging. Really, however, it is the blow and the bite that kill, not the " hug." But our brown bear would have to be " cornered," as we say, before attempting to kill a man.

He would kill a horse or a deer without hesitation, but Bruin, like every other wild animal which shares a land with men, has learned to fear a human being. A bear in an inhabited country, even if it has never before seen a man, knows by instinct that here, in this small creature walking on two legs, is the most mysterious and fearful thing in the world, and if we were not too startled at suddenly meeting him we should roar with laughter at the great " Woof ! " that he would utter as he scampered for dear life to a place where he thought we could not follow him.

There is another bear, larger than the common brown species, of which we might well be more afraid, and that is the grizzly bear of North America and a certain part of Asia. Except in places where it has been much hunted and thoroughly scared by guns, the grizzly will attack a man as soon as it sees him. It is not to be wondered at. He is ten times the weight of a man. Some of the biggest have been declared to weigh as much as 1800 pounds, and there is no doubt as to grizzlies of 1400 pounds having been slain. A fair-sized man in good hunting trim may weigh only 140 pounds.

Except for his manufactured weapons, man has nothing with which to oppose the grizzly—nothing but his brain, which enables him to trick the bear. The grizzly has teeth of enormous size and power, while his claws are the biggest of all bears' claws; but, happily, guns have taught this giant to behave with caution when he meets a man. There is food enough for him. The grizzly and the Polar bears are the two chief flesh-eaters of the bear family. Wherever the tall wapiti deer are, there you will find the grizzly bear. One has been known to kill a great bison, breaking its victim's neck with a single blow of its paw. Another carried away, over rough ground, a wapiti weighing nearly half a ton. Need we wonder, then, that this grizzly bear should be called *Ursus horribilis*, meaning that he is the "horrible" or "frightful" bear?

POLAR BEARS

There is a yet bigger bear than the grizzly, the mighty brown bear of Alaska. Travellers who have had experience of this bear say that it really compares in size with the frightful bears that used to live in the caves of England before history began. We can judge only from its bones what that bear was like, but it was indeed a monster. Of course, they had bears later than that in England, and we find a valuable record of them in an unexpected quarter. Norwich, which is famous today for its lovely little canaries, must once have been equally famous for its bears, for when Edward the Confessor was king this old city had to furnish him with a bear every year as a tribute.

When we say "Savage as a bear," we think of bears as never anything else but savage, but some of them are quite playful in a wild state. There is no more amusing sight than to watch the bears at play in the roomy enclosures at the New York Zoos. Of course, the play of such great beasts is, in a way, rather terrible, for none of us knows at what moment the desire for play may give rise to the instinct for battle. The danger of bear play was shown at the Zoo in London not long ago. A bear, not fully grown, was at play with a small bear from the White Sea. The little bear was not in good health, and could not hold its own with its rough playfellow, so that perhaps its play turned to savage defence. We cannot say at what point the game became a battle, but a battle it did become, and the larger bear, seizing the other by the throat, half throttled and half drowned it, and then, when it was dead, dragged it to its den, doubtless intending to eat it. Fortunately, the keepers were able to get the dead bear away, and so rob the victor of the fruits of his victory.

There is in the bear, then, the love of play found in other untamed animals, but here, as with the cat and the tiger, we find that the play is only a milder form of war.

A bear which attacks a man, if he is not killed at once, pitches and throws him about from paw to paw as a cat does with a mouse. It does not attempt to devour him until he is quite dead, and to this fact many a hunter has owed his life. Lying perfectly still, he pretends to be dead, and the bear, withdrawing some distance, sits down and watches to be quite sure, so enabling the man to reach his gun and fire a shot which kills or at any rate disables his terrible foe.

But let us say a good word for the bear. All bears are passionately devoted to their young. They are faithful unto death. Many wild animals will eat their dead offspring; rats will kill and eat weak or injured members of their own family. But the case is different with these great animals. Here are two instances in point:

The first comes from Russia, where a count shot and killed a bear cub. It was dark at the time, so that the body could not be found until the morning. When it was found, the dead cub was placed in a cart and driven to the count's home, fifty miles away. The trophy had no sooner arrived there than a big bear entered the park. It was the mother of the little victim, come to claim her slaughtered baby. She had travelled all that distance across country as fast as the horses, and must have mourned all night beside the body of her little one. The count was so touched by the incident that he had a monument erected on the spot where the bear was killed, telling this story of a mother's love for her offspring.

A LIVE TEDDY BEAR, THREE WEEKS OLD

Perhaps more remarkable is a story told by Mr. Roosevelt, who, when President of the United States, was witness of a striking instance of a she-bear's affection. His friend Dr. Merrill, of the United States Army, was with him on a hunting expedition, and pursued an elk into a deep, rocky chasm, where, on turning a sharp corner,

THE POLAR BEAR BEGS

the doctor came unexpectedly upon a large she-bear lying on a bare patch of newly beaten earth. She rose at once, and charged, but was killed. Then the hunters, curious to see what lay under the patch of earth on which she had been resting, made a careful examination. They found that the earth, after being dug up, had been roughly beaten down again by the paws of the bear. At one spot a tuft of hair was showing. They dug down, and found the body of a well-grown cub. The curious thing was that the skull had been crushed and the brain removed. The hunters solved the mystery. While the mother was away, some other animal, probably a grizzly or a puma, had dealt the cub a terrible blow, killing it and partly eating it, and the mother, returning, had driven away the murderer, buried the body of her young one, and lain down to guard the grave and avenge the death of the little one if the assailant returned.

We have seen that bears can eat pretty well everything. We must add fish to their diet. The great bears of Alaska and Siberia, and others in lands where the rivers become choked every summer with millions of fish, live for weeks as fishermen. This is a particularly profitable time for the great Alaskan bears, but they get their greatest store of fat, not from fish or flesh, but from acorns and pine nuts. As they are not good climbers, they must get the nuts as best they can, and what they do is to creep round to the little storehouses that the mountain squirrels make, rip open the tiny barns in the earth, steal the nuts, and grow fat on them.

That is almost the last thing they do before they go into their winter sleep, so that they might be expected to have very kind thoughts about squirrels as they nod off to dreamland. But their thoughts are not like ours. When they think of squirrels, it is not with gratitude, for the truth is that a good plump squirrel itself is a meal which no bear can withstand.

There is one group of bears that could be found at large today, and that must be the group to which belonged the famous bear that huffed and puffed so strangely in the nursery story. There really is such a bear. It is the sloth bear of India, the funniest-looking bear that ever was seen. It has the poorest of teeth, and so it is a great fruit-eater. Really a part of its diet should satisfy a poet, for it is honey, sweet fruits, and scented flowers of the forest. Nothing could be nicer. But the sloth bear has one passion—it is ants!

A POLAR BEAR GREETS HIS VISITORS AT THE LONDON ZOO

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The ants that he seeks are mainly the white ants. These are really termites that build hills almost as solid as masonry, with systems of galleries below. The bear rips these hills open, so exposing the upper galleries. But these run deep down into the earth, beyond easy reach of his paws. So he huffs and he puffs to get at the contents, puffing to blow away the dust and grit, and then, snuffing violently, sucking up ants and grubs into his mouth. He would be an intolerable guest at table, for when he is thus feeding you can hear him two hundred yards away. And when he retires to his cave, or to some deep recess in the rocks, for his midday snooze, he is still heard there, huffing and puffing as if still at his meal. This bear does not take a winter sleep, for the weather is always mild in the places where he is and where he can go.

The colder the winter, the more certain is it that we shall find few bears in the open, and the longer the winter, of course, the longer they will be fast asleep in their fortresses. Many of them take to caves, some to hollow trees, and others creep into thickets and let the snow cover them. That is the winter way of the Polar bear, the biggest of all save its Alaskan and grizzly cousins. These white monarchs of the Arctic wilds are often nine feet long, and weigh, when in good condition, from 600 to 800 pounds. Their food consists of the flesh of seals and walruses, of dead whales, occasional fish, and, in the spring, young grass and certain kinds of seaweed. They

THE POLAR BEAR IN HIS SOLITARY HOME AMID THE ICE AND SNOW OF THE ARCTIC REGIONS

KING OF THE LAND BEYOND THE REACH OF MAN—THE WHITE BEAR OF THE FROZEN NORTH

THIS THRILLING PICTURE OF THE POLAR BEAR, THE MONARCH OF THE ARCTIC WORLD, IS PAINTED BY MR. BRITON RIVIERE, R.A.

A SLOTH BEAR. NOTE ITS LONG WHITE NOSE

A THRILLING MOMENT IN A TRAVELLER'S LIFE
From the picture of "The Hunter," by J. C. Dollman, published by Thomas Forman & Sons

go to bed early and rise late. Now, we do not know for certain whether the majority of Polar bears go to sleep for the entire winter, or whether it is only the mother bears that do so.

As the winter season draws on, they come farther south from the Pole, and from certain parts they disappear. We have not yet discovered whether all those that disappear have buried themselves, or whether only the female bears have done so, while their husbands and growing children have moved off to quarters farther south, where food will be abundant. We do know that many male bears and growing cubs hunt all through the winter, but we cannot answer for all of them.

As to the females, however, there is no doubt. When September is drawing to a close, father and mother march off to a favourable spot. The mother bear digs herself a sort of underground cave in the snow, and the falling snow-flakes cover her over, one little channel being kept open by her hot breath, enabling fresh, sweet air to reach her. There she stays all the winter, from October till April or May, according to the weather. The father bear, if he does not go to sleep, goes off with his big boys and girls, we suppose, to hunt down by the shore, or perhaps he swims out to sea and reaches a floating island of ice, where he can catch unwary seals. All the time the mother bear is asleep in her warm house under the snow, her magnificent mantle of pure white fur keeping her as snug as a child in its cot. When she comes out at last, she is not alone. She comes forth to seek her lord, bringing him one or two fine, bouncing baby bears. By one of the most wonderful provisions of animal life, she is able, while fasting, to support her own life all through the winter, and feed her baby with rich milk. This protection is absolutely necessary. A baby bear born out in the cold would die. The Polar bears at the Zoos cannot bury themselves in the snow, so their cubs always die of cold. Yes; a baby Polar bear, living amid eternal ice and snow, dies like the baby of some tropical animal if exposed to the cold.

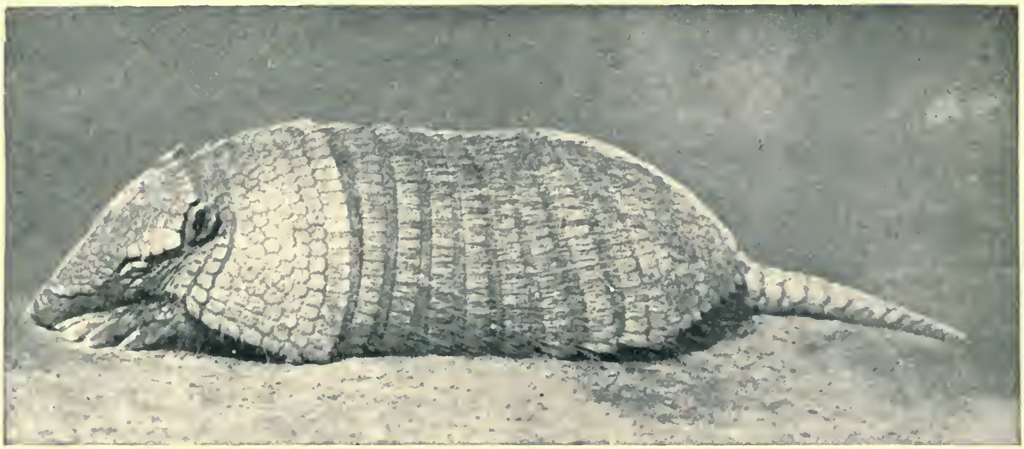
One brave Polar mother and her two cubs were pursued over the ice by a party of sailors. Alone, she could easily have got off, for a Polar bear, unless it is very fat, can outrun any man. But she would not leave the little ones, and the men gained upon them, so the mother drew back, still urging them on, carrying one a little way, pushing the second along, then flinging both forward, one after the other. The little ones welcomed her help in this way, and, placing themselves directly before her, waited for the helping thrust from her paws.

They were shot forward by the blow; then, recovering their feet, scuffled along until she drew up to them, when each in turn would prepare for another push. So they got along as fast as they could, and it is splendid to know that they escaped from the sailors, who were manly enough to enjoy this spectacle of a mother's devotion, and to tell the story in a book.

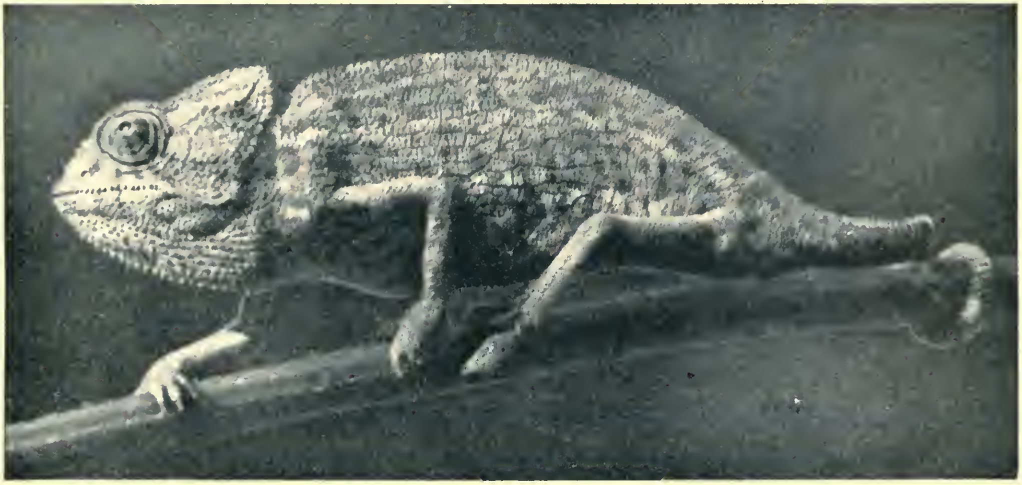
There are human mothers who have yet something to learn from the mother bear of the snows, fast asleep with her baby under the great white blanket that covers her home.

A BLACK BEAR OUT FOR DINNER

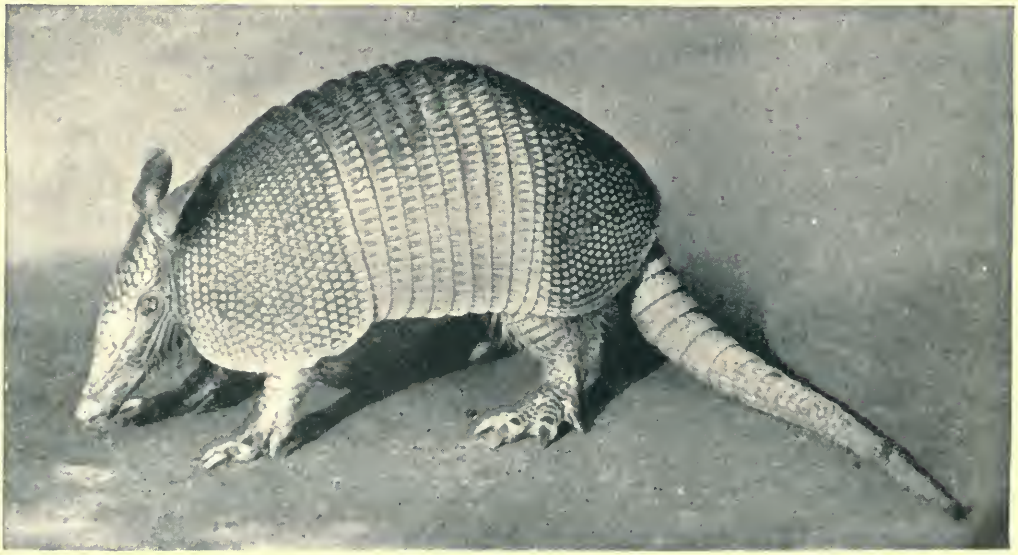
THE CLEVER DEFENCES OF NATURE'S CHILDREN



THE HAIRY ARMADILLO, WHICH IS DEFENDED AGAINST ITS ENEMIES BY A COAT OF POWERFUL ARMOUR



THE CHAMELEON, WHICH CHANGES COLOUR AT A MOMENT'S NOTICE TO DECEIVE ITS ENEMIES



THE PEBA ARMADILLO, PROTECTED FROM ATTACK BY A COAT OF ALMOST IMPENETRABLE ARMOUR

WONDERS WE MAY SEE ALIVE

A PEEP AT SOME OF THE CURIOUS THINGS
THAT SHARE THE WORLD WITH US

CREATURES OF THE WILD THAT HAVE COME TO TOWN

AMID the streaming roar of the city we may, by turning aside, look upon sights as strange as ever the wildest man saw in jungle and forest. We may see here, at the New York Zoo, quaint and curious creatures from the frozen ends of the earth, from the steaming forests of Africa and the East. We may see types of animals far advanced in evolution ; we may see some that appear to have taken the wrong turning on life's highway, and to have developed, in the most fantastic way, to suit a life with which, we imagine, they were not at first meant to be content.

If we went to sleep in innocence of the existence of these creatures, and awoke to find ourselves among them, we should not believe our eyes. We should think it all a dream. Who could believe in the great ant-eater ? For over twenty centuries men disbelieved the story of an Egyptian explorer who had seen what we now know were gorillas ; and more than twenty centuries later they disbelieved the European who saw them. Now, what would they have said of the ant-eater had they been told that such an animal existed ? Even when we stand face to face with an ant-eater he is hard to believe.

Look at that grotesque head of his. Where is the mouth ? He does not seem to have one. For so big an animal, with his terrible claws and his thick coat of hair, we should expect a mouth and jaws as large and powerful as a badger's. But he has a head which seems to belong rather to a bird than to an animal, with a mouth which is simply a long, cylindrical tube. We poke fun at little Tommy Noddy, all legs and no body, but the ant-eater seems to be all nose and no jaws. We might fancy that Nature had begun an experiment here, that she had either designed an experimental animal vacuum cleaner, or else tried a sort of variation of the elephant's trunk. But the elephant has a pair of jaws, mighty jaws indeed, with his trunk ; the ant-eater has only a pretence at a trunk, and neither upper nor lower jaw. How, then, can this freakish creature make a living ? Its natural method is to rip open with its claws the great hills that the white ants—or termites—make. Indignant at this assault upon their citadel, the ants rush forth, to be instantly secured by their enemy. From the long snout shoots forth a slender, wormlike tongue, covered with a thick, sticky substance. The tongue sweeps round in a semicircle, and everything within its radius is caught up, drawn into the snout-like mouth. That is the end of the story for those ants. They are swallowed on the spot.

That, then, is the secret of the extraordinary mouth of the great ant-eater. Slowly, by small degrees, its ancestors have developed this toothless funnel, through which termites are whisked to their doom. It is the age-long pursuit of ants which has led to the change. Many experiments, such as Nature seems delighted to try, have proved that this is the best form in which the great ant-eater and his lesser cousins can get their food.

There can be no doubt about it, for smaller ant-eaters have just the same fantastic snouts, all living where the white ants are. If you see a tree in which a particular species of white ant has begun to colonise, making little earthen galleries with tiny citadels on the trunk, there also, in the same tree, you may expect to find one of the lesser ant-eaters. And, just as the habits of the ants vary, so do those of the ant-eaters. We have ant-eaters, for example, which move and hunt by day, and ant-eaters which move and hunt by night. The monster of the tribe is a night-hunter, and keeps to the ground ; he leaves the daylight and the trees to his smaller kind. We should expect that, having mighty claws, he would be a burrower, but he is not. He lies above ground, going to sleep practically wrapped up in his great tail, which he raises over himself as if it were a sort of tent.

The great ant-eater is such a fascinating creature that we could spend a whole day in his company, but there is a long procession of strange creatures behind him in our pageant, so let us move on to a second—another ant-eater, but very different in type. This one is called an echidna, from a Greek word meaning a sort of impossible adder, one of the reptiles that never were.

A VERY IMPORTANT GENTLEMAN TAKES A WALK IN BRONX PARK—A SHOEBILL AT THE ZOO

This prickly gentleman, with little spines growing through the hair of his back, impressed our forefathers as a fabulous adder—yet here he is alive. He has a sort of tubular beak for a mouth, with no teeth, but with sharp spines on his tongue and his palate. The mother echidna lays eggs—one a year. She makes no nest, but when the time comes for her to deposit her eggs there grows on the underside of her body a wonderful little pouch, which is nest, cradle, and larder too. When the egg is laid, the mother places it within this pouch, and there the young echidna is hatched. Within the pouch is the source of a milk supply that keeps it alive.

The echidna, like the great ant-eater, has big, powerful claws, but these are for burrowing, and the amazing thing is that, instead of all four feet pointing forwards, the hind feet point outwards and *backwards*. Why that system should be of advantage it is not easy to say, but we may learn a little by watching the animal burrowing into the soil of its cage at the Zoo, as it had been used to do in its home in Australia. The first captive echidna brought to Europe was placed in a boxful of soil, in which he at once began to mine. The rascal did not know when to stop; it mined straight through the bottom of the box in which it was housed. Immensely powerful are the sharp claws of the echidna.

Powerful, too, are the claws of the remarkable Peba armadillo, heavy with bony armour. Here, again, we notice a very narrow, cylindrical type of mouth, and those of us who would appear wise without taking the trouble to be wise would say, "Bother, another ant-eater!" But we should be wrong, for this armadillo might take an ant or two, as most monkeys will, by way of a change, but, to tell the truth, he is really a scavenger, a very important scavenger on the South American plains. Upon those great tracts of country many animals die—from natural causes, from disease, and we know not what—and if there were no scavengers such as the armadillos, the vultures, and other destructive influences, their bodies would lie long to spread pollution. The Peba armadillo is one of the very few flesh-eating animals that lay up stores of food for themselves.

Another armadillo, the hairy one of the race, is, like the Peba example, clad in bony mail, from the tip of his nose to the tip of his tail. He gets his name from the fact that thick, bristly hairs protrude through his coat of mail. These armadillos—and their cousins the pangolins or scaly anteaters–resemble the porcupine in one thing. Having developed a suit of armour for their protection, they have still found that armour insufficient, and some other device has been necessary to keep them abreast of their competitors in the race of life. For all their armour, they can roll themselves up into balls, like a porcupine. That is an advantage they possess over the old armoured knights. Armoured men, when they were unhorsed, sprawled helpless on the ground; they could not curl up and expose an impenetrable surface to the enemy, as the armadillos can. Far back beyond the days of armoured men there were greater forms of armadillos than any now existing—giant glyptodons, as they were called. But they carried too great a weight of mail, and have vanished like the armoured knight. But we may take it that Nature is not satisfied even now with her armadillos. She appears to be trying yet another pattern, which is the shaggy armadillo of Peru, in which a thick coat of hair is grown, so that at a distance it is impossible to tell this armadillo from an ordinary fur-covered animal. Is it possible, one wonders, that armadillos will in time discard their heavy mail, and become faster afoot and furred?

There are at the Zoo some of the strangest mammals in the world. There is an aye-aye, the most remarkable of all the lemur family; and two elephant seals, young giants from far-away seas, which, when they reach full growth, are the biggest living things in the waters next to the whales. The aye-aye gets its strange name from its cry. It is one of the world's mysteries. Its native home is Madagascar, the abode of the lemurs.

AN ENLARGED PORTRAIT OF MR. SHOEBILL

Though the aye-aye is really a lemur, it is so unlike other lemurs that some naturalists place it in a family by itself. It is a most perplexing creature, for, while it looks like a long-haired cat, its teeth are like the teeth of rodents—with this strange difference, that, while it has only two pairs of teeth each pair comes apart when in use, so that it appears to have four sets. Its feet are also peculiar. Really these feet are four hands, like those of the rest of the lemurs and all the monkey tribe, but the aye-aye's fingers upon the fore-paws are unlike anything else among animals. They are very long and very thin, and what we should call the middle finger is like a withered organ, it is so strangely skeleton-like. Each of these fingers is armed with long claws, and serves as a means for getting food. The first aye-aye known to Europe was discovered in 1780; it was described a hundred years ago by the great naturalist Cuvier, who took it to be a kind of squirrel; but still we know very little of its life in the wilds. But this one thing we do know—that, while in some respects it is linked with lowly bygone forms of life, it is, on the other hand, connected with the lemurs, which are the humblest type of animals in the order called Primates, of which man himself is the head.

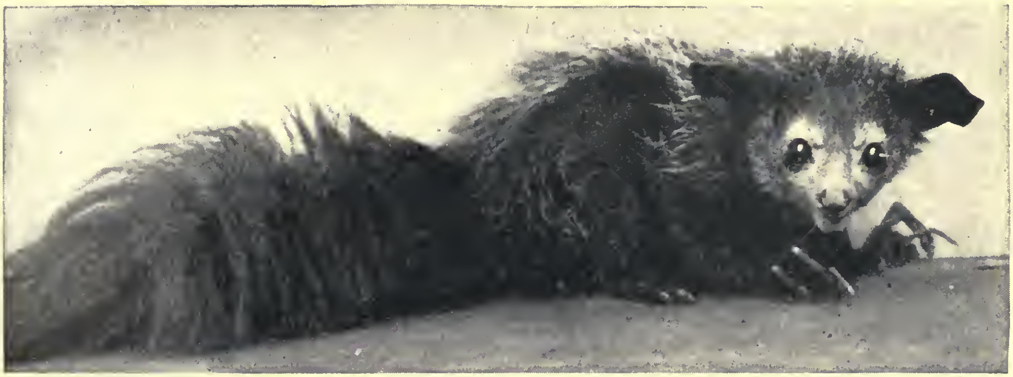
There is not so much mystery about the sea-elephant as about the aye-aye, but we rub our eyes, on seeing one of these creatures of the sea, to realise that their ancestors walked on dry land. It is called a sort of elephant because of a broad, fleshy trunk which the adult sea-elephant develops. It might seem that Nature at one time intended to give them trunks resembling the elephant's, but the trunk and the plan stopped short at a great broad flap hanging down at the mouth, with the nostrils at the lower end.

The first sea-elephant was taken to England in 1912, in mistake for a full-grown Ross's seal. When experts found that it was really a true elephant seal, the excitement was almost as great as if a gorilla had come to town, for it was the first ever seen there. The youngster thrived well for two years, and greatly enjoyed its daily ten pounds of fish. But it died quite recently, not from excess of buns, but from a disease resembling influenza. In its place the Zoo is happy to possess others, and it is hoped they may be reared and live long and happily in captivity, far from their desolate homes, where the silence is broken only by the roll of waves, the chilling scream of sea-birds, and the grunts and roars of the sea-elephants themselves.

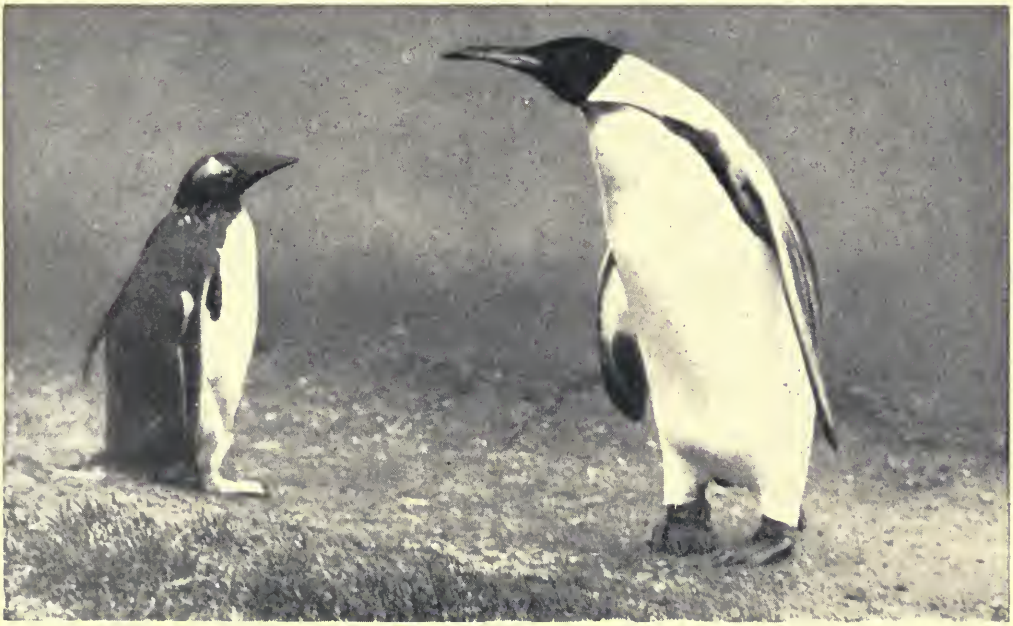
THE LAUGHING-STOCK OF THE ZOO—A PAIR OF PELICANS

A curiosity of quite a different sort is the olm, one of the most ancient of animals. Some years ago a clever man of science turned an axolotl into a salamander. It was found that the axolotl, with its big, newt-like body, its flat, frog-like head, and its external gills, is simply an early stage of the salamander, not a perfect creature in itself. So long as food is abundant and fresh water plentiful, the axolotl refuses to grow up, but if kept short of water and food it assumes the parent form, and comes out to live on dry land—a salamander. Now, it may possibly be found some day that the olm is another of this type of animal wonder. The European examples live in deep waters far down in the heart of the Alps. They look like little fishy snakes, about a foot long. Although sightless, they have eyes hidden under their skins, and four funny little legs, the two pairs quite a journey apart. And they, like the axolotl, have their gills outside. Now, we do not know that the olm may not be able to change into another form, as the axolotl does. We do not understand its natural habits, for we never see the olm unless heavy rain, or the melting of the snows, fills up the interior of the mountains, so that their home in the

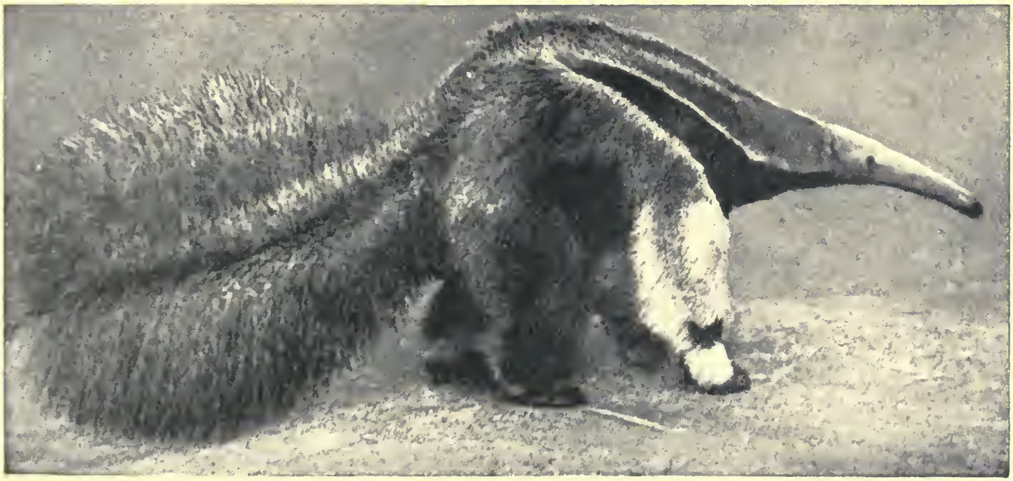
THREE COMICAL MEMBERS OF ANIMAL SOCIETY



THE COMICAL AYE-AYE, WITH ITS HUGE EYES AND ITS ENORMOUS TAIL

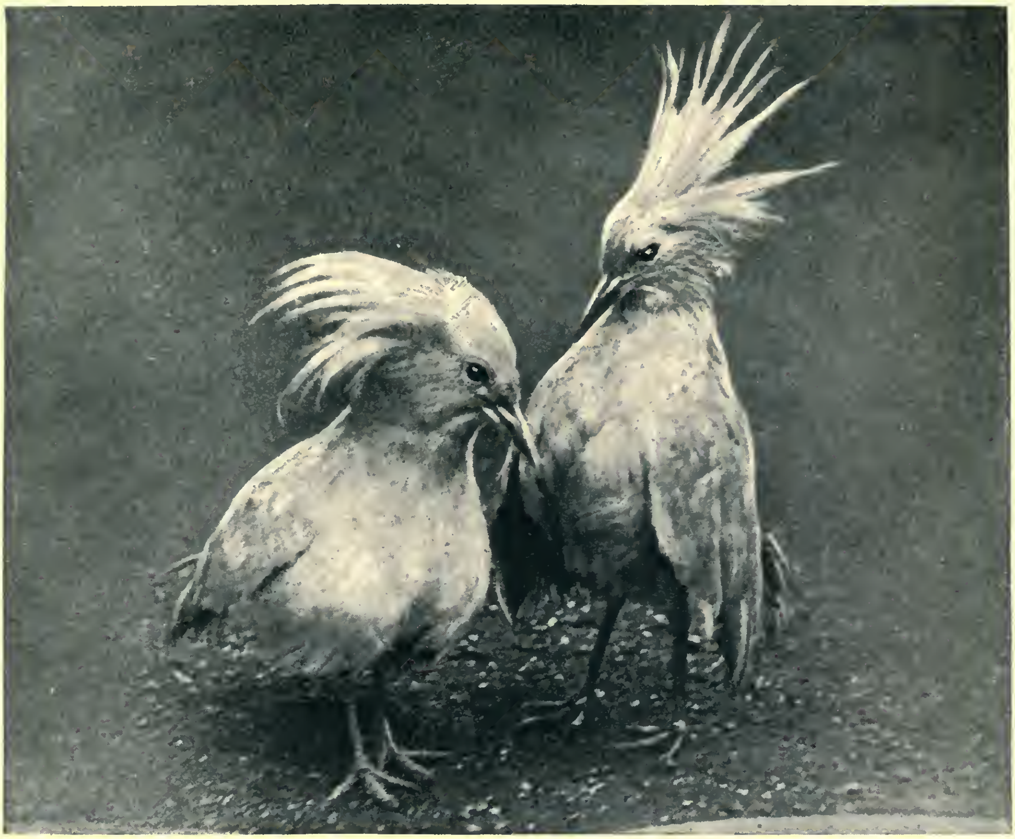


THE PENGUINS OF THE SNOWS, WHICH SEEM ALMOST HUMAN IN THEIR MOVEMENTS

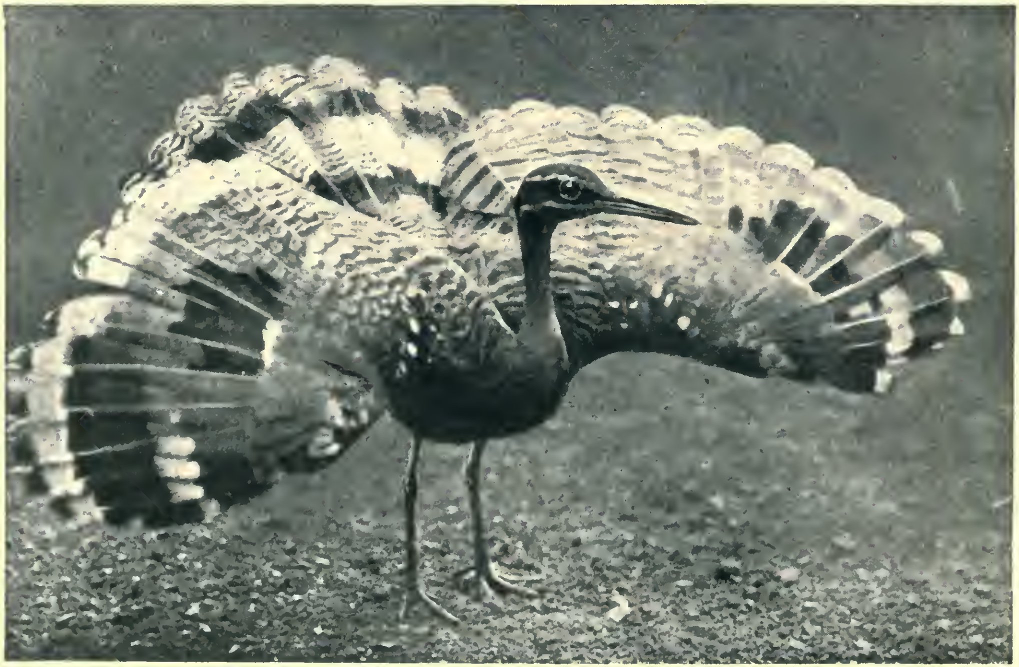


THE GREAT ANT-EATER, WITH ITS ALMOST UNBELIEVABLE SHAPE

COMEDY AND VANITY AMONG THE BIRDS



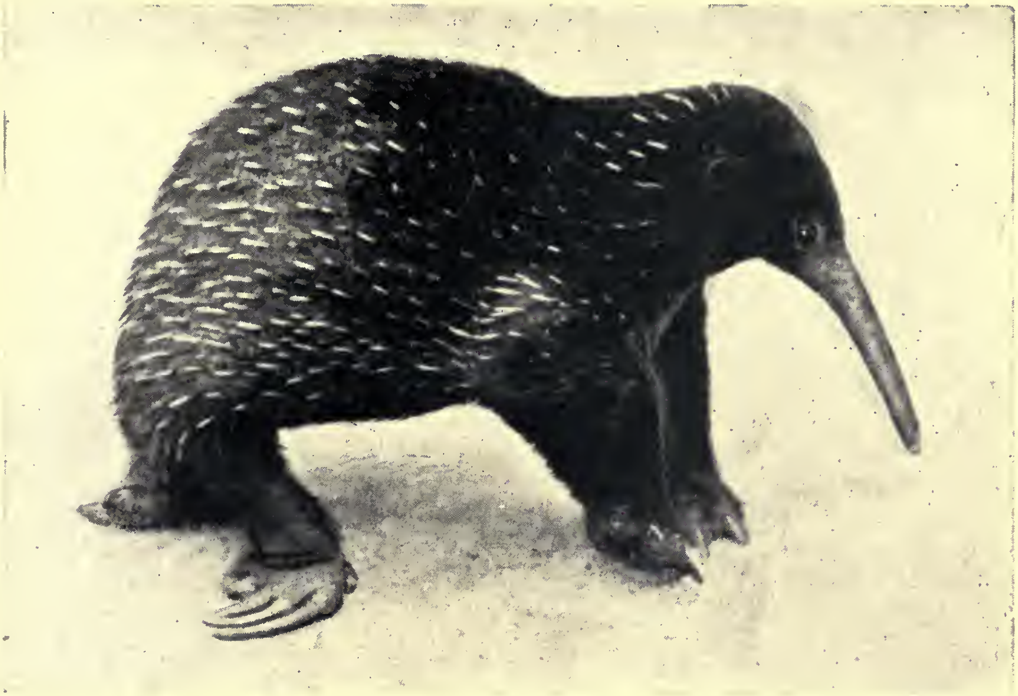
A PAIR OF KAGUS, THE QUAINT CREATURES WHOSE ANTICS AND CRIES CAUSE GREAT AMUSEMENT



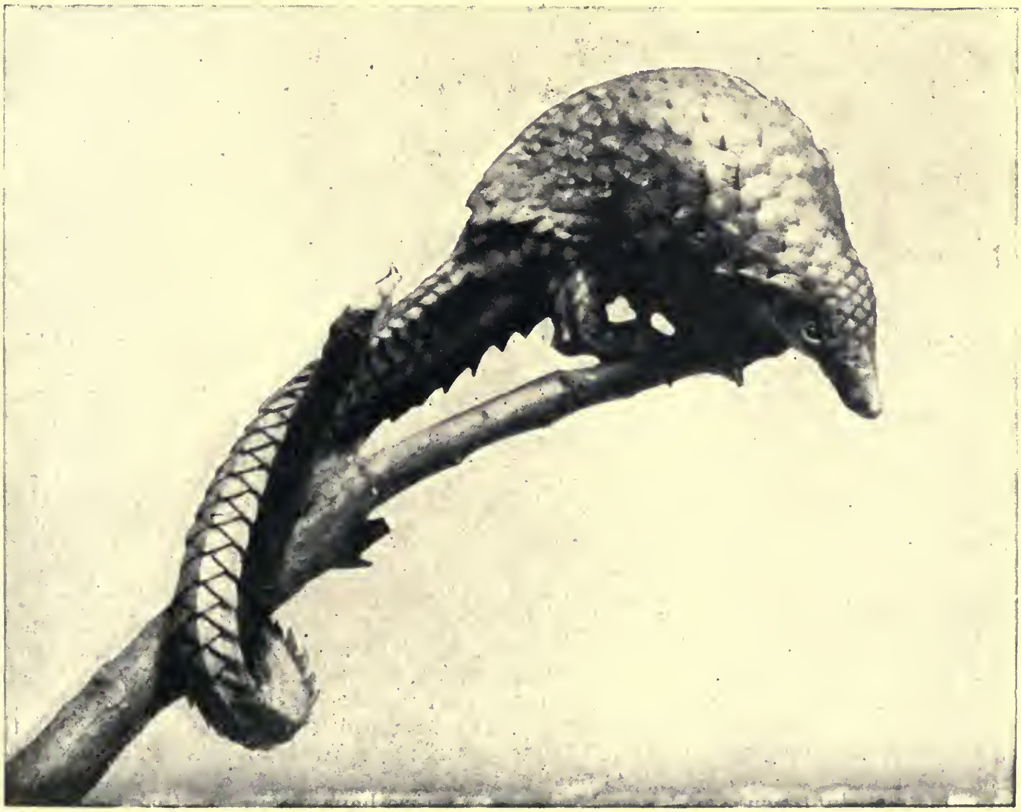
A GREETING TO THE SUN—THE SUN BITTERN SPREADING OUT HIS LOVELY PLUMAGE IN THE SUNSHINE

The photographs on these pages are by Mr. W. S. Berridge, Mr. Seth Smith, and others.

LINKS WITH THE ANIMALS OF AGES PAST



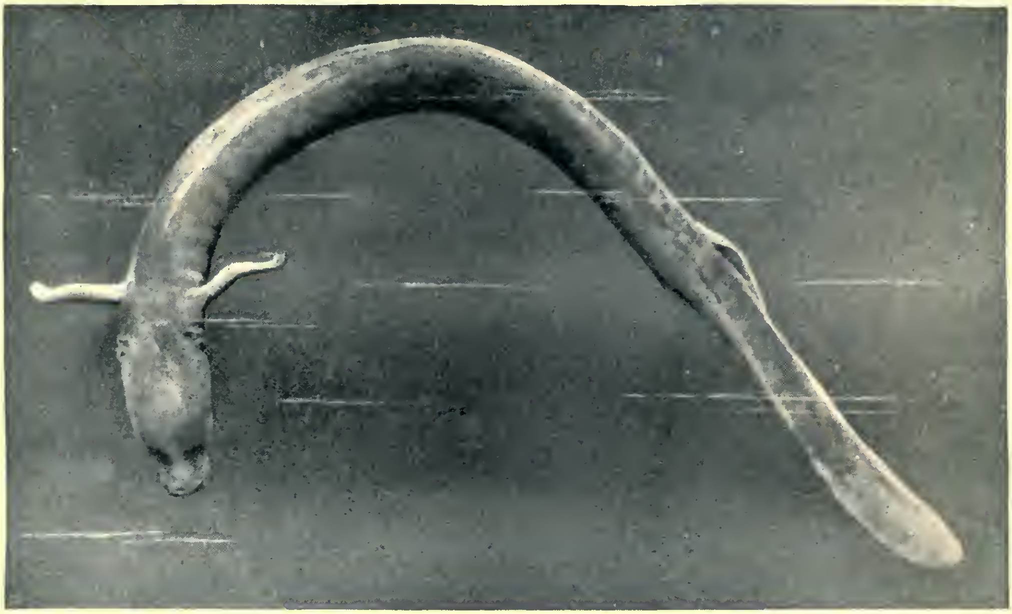
A LINK WITH THE ANCIENT REPTILES BEFORE THE MAMMALS CAME—THE EGG-LAYING ECHIDNA



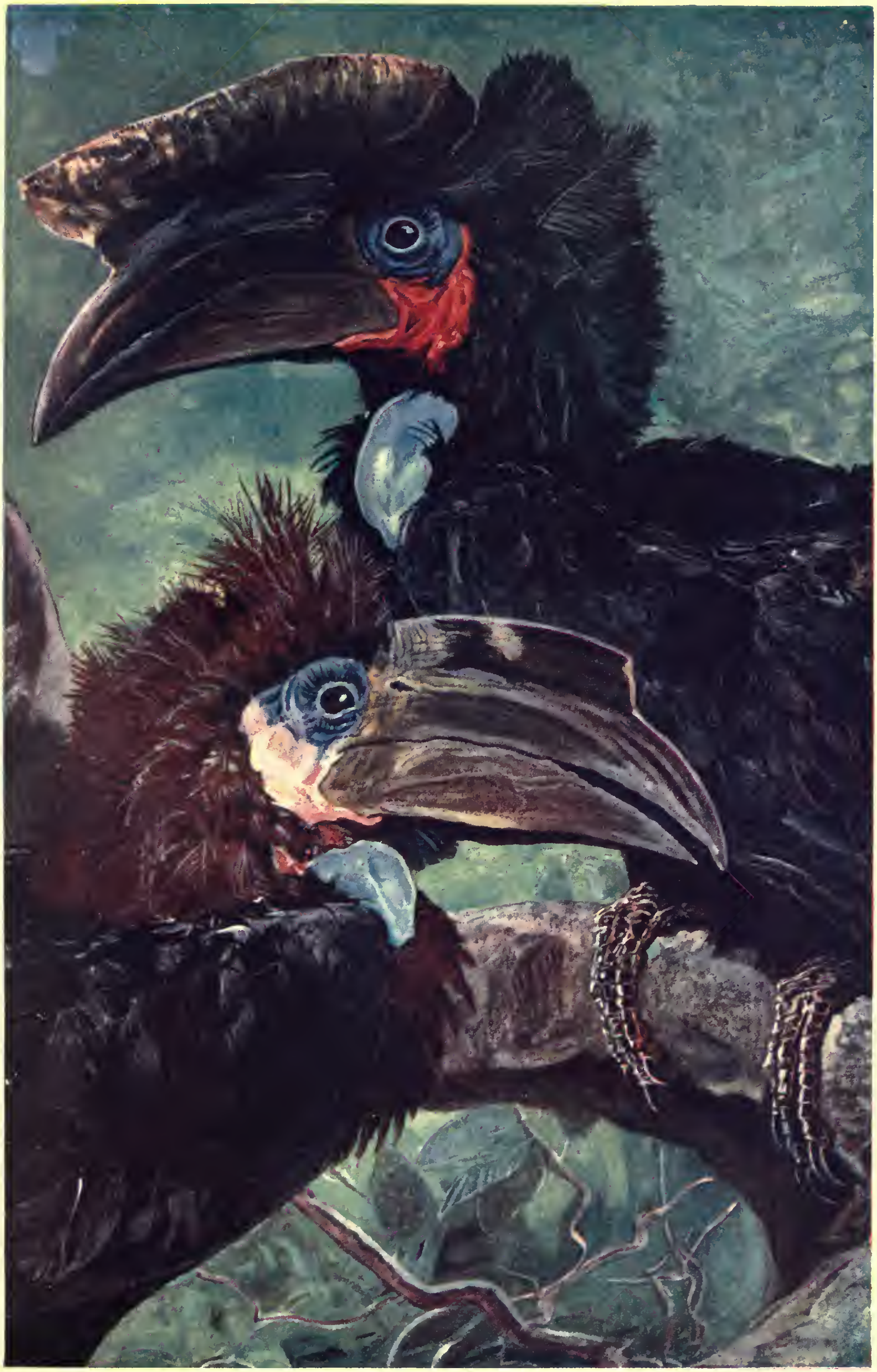
THE PANGOLIN, AN ARMOURED INSECT-EATER LIKE AN ANIMATED FIR-CONE dark overflows, and casts them forth into the open. In captivity they avoid the light, showing that some sensitiveness remains in their eyes ; they go for long periods without food—when they choose—and when hungry they eat the shell-life in fresh water. When water is short, and allowed to get stale, they rise to the surface, and, opening their mouths, gulp down fresh air, and let it come out through their gills. There is probably a great secret in the life of the olm which nobody knows.

A familiar friend among the wonders we may see alive is the chameleon, which, clinging with hand-like claws to the branches in its cage, rolls its tiny eye with such a suggestion of unearthly wisdom. It is famous as our greatest "turn-coat." From a greyish-green colour its body can quickly turn to a vivid grass green or to a dull black, whichever will suit its background. That is the chameleon's way of getting a living. He makes his colour suit his surroundings, so that he may not be seen, either by the enemies he fears or by the flies he catches. Next to his changes of colour and his extraordinary eyes, his tongue is his greatest wonder. He does not move to catch a fly—he would miss every fly in the world if he did, for he takes so long to think about shifting a foot. Instead he shoots out an amazingly sticky tongue, the longest tongue we know, which is to him what the net is to the fisherman or the lasso to the cowboy. The fly is ensnared in the glue-like substance of the darting tongue, and is withdrawn into the reptile's mouth before it has time to ask itself the reason why.

But let us come to flying life. Here is a group of those birds that Antarctic explorers love. The penguins have changed their wings into paddles, and row with them, too. The loss of wings has been followed by a change in balance, so that a penguin has its feet set far back, and is the only upright bird in the world. When we examine its feet, we find that they are not webbed, but really adapted for walking, like our own. When penguins are on land, standing in rows, looking like little children with their pinafores tied on, they cannot readily escape, so sailors think them boobyish birds. But the fact is that, in spite of their comical appearance, they are very intelligent, and can be taught all sorts of tricks. The pelicans, among the most grotesque of feathered creatures, with their great beaks and heads gravely swaying, are among the cleverest bird fishermen, and, although they look hopelessly comical, their flight, as they soar in clouds into the heavens, is as beautiful and graceful as that of the flamingo or the heron. We must be careful not to overlook the shoebill or the boatbill. Here we have distant relatives. The boat-

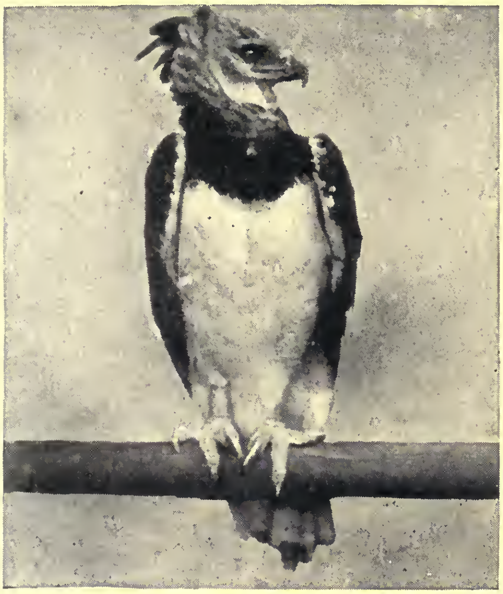


THE OLD MAN OF THE WATERS—THE OLM, OR PROTEUS. A STRANGE, BLIND TENANT OF THE HIDDEN WATERS OF MOUNTAIN CAVES

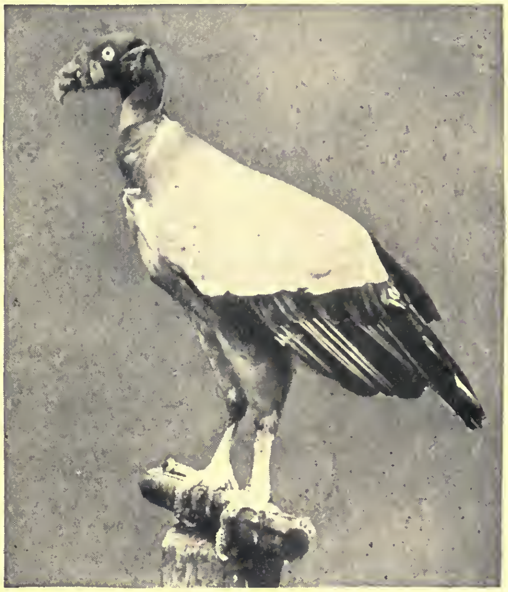


A PAIR OF WEST AFRICAN HORNBILLS WITH THEIR COMICAL BEAKS—DRAWN BY SIR HARRY JOHNSTON

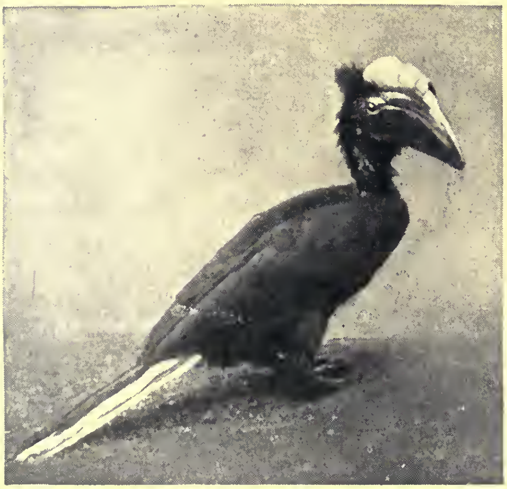
BIRDS THAT LAUGH AND BIRDS THAT TERRIFY



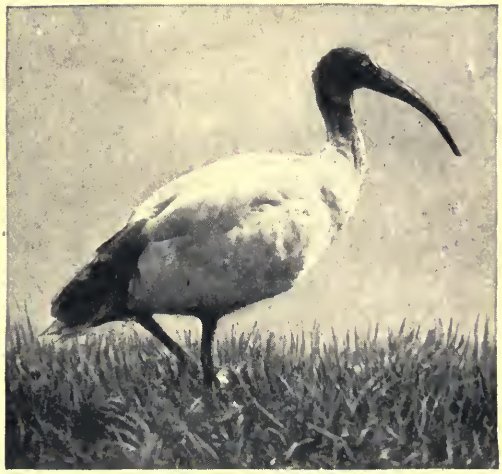
THE HARPY EAGLE



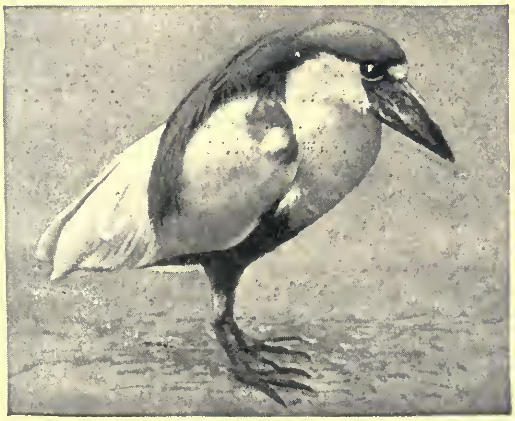
THE KING CONDOR



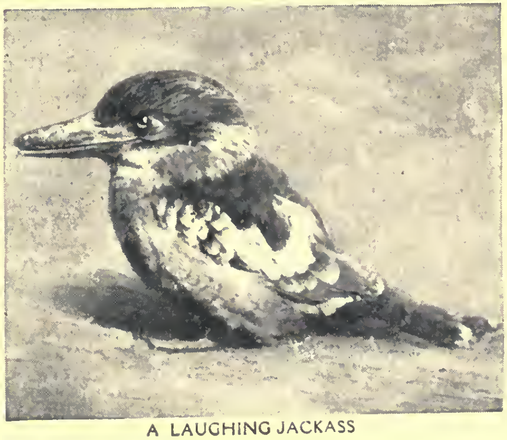
THE HORNBILL



THE SACRED IBIS



THE BOATBILL



A LAUGHING JACKASS

bill lives in the swamps of South America, and its curious beak is a sort of shovel, or dredge, with which the boatbill grovels into the bed of the river or the soft mud of marshy land.

The shoebill, on the other hand, belongs to the heart of Africa—to the White Nile—and is never seen near men. It is a monster bird, and stands, sometimes upon one leg, breast-deep in the river, with its broad beak dipped into the water ready to catch the first fish that comes within its reach. Once the beak strikes there is no hope for the fish, for the cutting edges of the bill are as sharp as a knife. The shoebills are intelligent. When fish do not come readily to isolated birds, several join together, form a half-circle round a number of fish, beat the water with their wings, and march steadily after the fish to a shallow, where the rest of the story is soon told. Comical to us, shoebills must look like towering dragons of destruction to the young finny swimmers of the Nile.

A YOUNG SEA-ELEPHANT AT THE LONDON ZOO

Colonies of other long-billed birds haunt the banks of the Upper Nile, the sacred ibises, which were so common in the land of the Pharaohs thousands of years ago. It is a strange sight to see a whole rookery of hundreds of thousands of ibises rise like a cloud, with their weird, long bills and their outstretched necks.

A still stranger beak is that of the hornbills, which in some groups is solid and heavy, and in others is hollow and light. The bills are used as defences against their numerous enemies, and also as trowels in plastering up the nesting-hole in which the female sits on her eggs, a curious habit described by Livingstone.

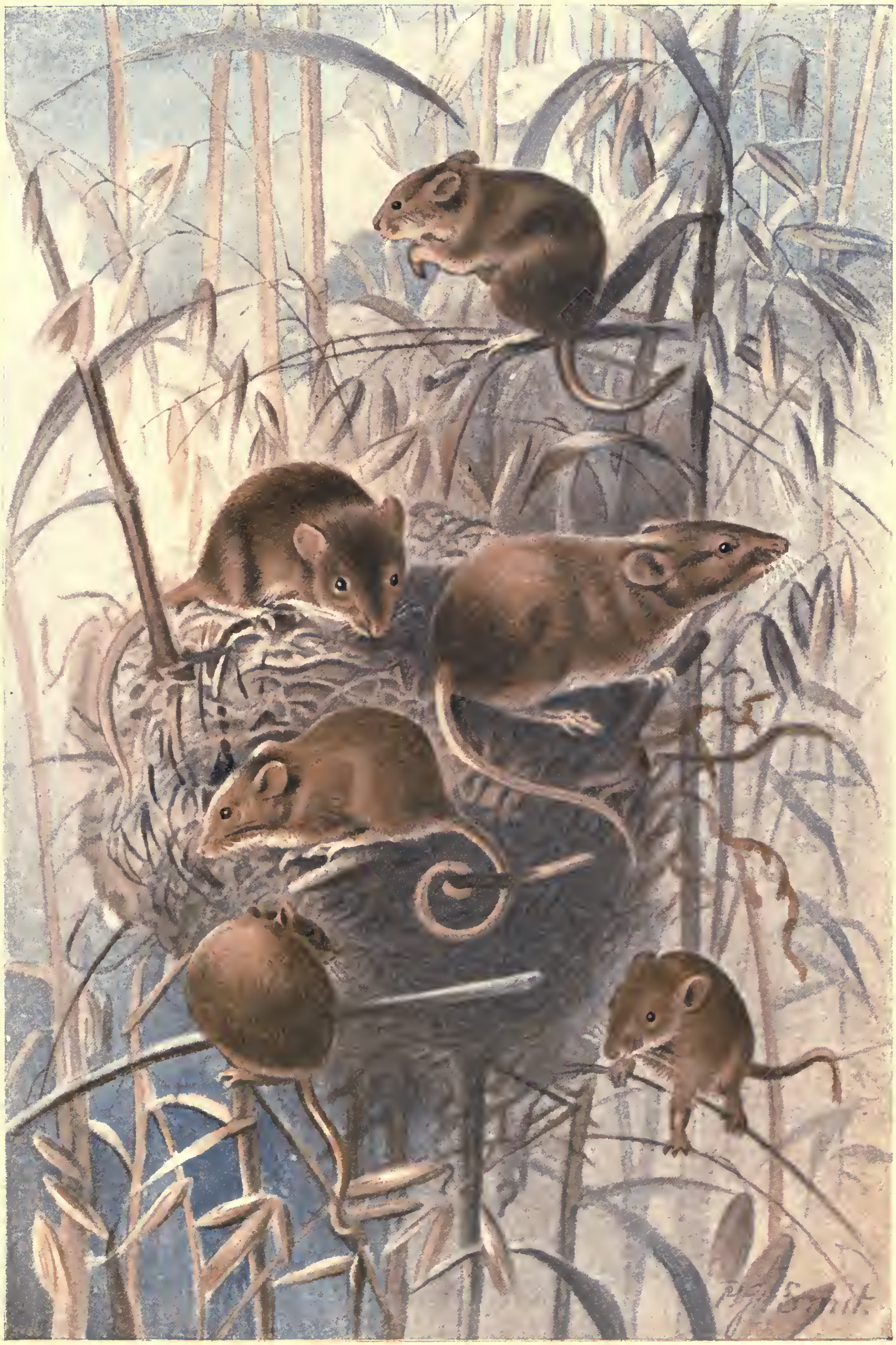
The king of all the comical birds, however, is the laughing kingfisher, a member of a group of birds which in some respects very closely resemble the hornbills. The laughing kingfisher, or laughing jackass, as it is called in its home in Australia, is a sort of king of laughter, as if life were one huge joke to him. These birds have a great robust laugh which only the lustiest of parrots could mimic. Wherever human habitations are found in the Australasian wilds, there these fine kingfishers, with long beak, long body, and short legs with curious feet, are also to be found, laughing at all hours of the day and night, as though they overheard the human conversation and thought it supremely ridiculous. In days when convicts were sent to Australia, more than one unhappy runaway was tracked to his hiding-place in the bush by the shrieking laughter of the kingfishers overhead, which espied him in his hiding-place.

Another humorist in birdland is the kagu from New Caledonia, a crane type of bird with a long, pendent crest rising from the back of its head, which must wave up and down like a galloping guardsman's plumes when the bird engages in its characteristic antics. A distant relative of the kagu is the sun bittern, a solitary bird which would recall to us some large and gorgeous butterfly if we came upon it spreading out its lovely plumage as it basked in the sun.

Nature has her splendours, but she has her horrors, too, as we find in the case of the king condor. At a distance it is a noble, upstanding, bold-looking bird, but when we approach nearer we find its head and beak weirdly coloured and blotched, while from its neck protrude masses of highly-coloured, unfeathered flesh, a strange combination of lurid absurdity with strength, grace, and agility, just as we find in the case of the mandrill. From the king condor we may turn to the harpy eagle, and wonder whether to laugh or shudder. This strange bird, with its terrifying features and its singular head-plumes, is something like a vision of absurdity peeping through a mask of evil and death.

Strange, indeed, are these wild creatures that have come—captive and against their will—to town; but all their strange features have their place in Nature's great purposes. They are part of the scheme by which great families of the animal kingdom triumph over circumstance and ensure their survival.

THE LITTLE INVADERS OF THE CORNFIELDS



TRESPASSERS WHO WILL NOT BE PROSECUTED

NATURE'S WONDERFUL WEB

THE CHAIN OF LIFE AND THE UNITY THAT SEEMS TO RUN THROUGH ALL THINGS

THE MARVELLOUS LIVING FABRIC THAT WE ARE ALL MAKING

IT is very pleasant to watch the surface of a quiet reach of the river on a summer evening when the trout are jumping.

We see a multitude of circles, big and little, which spread till they touch one another. It would be very difficult to take account of all the influences of circle upon circle ; and the intricacy which we like to look at is a fine image of what is true in the world of life. For no creature lives or dies quite to itself, and each one's business is like a spreading circle influencing other circles.

Who would think that the pied wagtails of England could have anything to do with the success of a sheep farm ? And yet the riddle is not very difficult. Sheep and lambs are often killed by a small leaf-like worm called a fluke, which gets into the liver and feeds on the blood. The early chapters of this liver-fluke's life are spent in a minute water-snail which is very common in pools in wet pasture-land. If the pasture could be perfectly drained, or if there were no water-snails in the pools, there would be no liver-rot disease in sheep. The fewer water-snails there are the less disease there will be. But the wagtail is very fond of eating the water-snails, and now the cat is out of the bag—the more wagtails the fewer water-snails, and the more healthy sheep.

Many of us know another sight as beautiful as the dimpled surface of the stream, and that is when acres of meadow are thinly veiled with myriads of gossamer threads, so delicate that we can scarcely see them until we stoop down and look along the ground. Then it is wonderful ; it seems as if the whole surface is covered with a living web, for all the silken threads are quivering. In many cases the threads are due to a shower of gossamer—that is to say, they are the discarded parachutes of small spiders that have made, or were trying to make, an aerial voyage. Sometimes they glisten with dewdrops, which add to the bewitching beauty. Robert Louis Stevenson was thinking of a spider's web thus decorated when he wrote of " every fairy wheel and thread of cobweb dew-bediamonded."

Now, the surface of the lea covered with the gossamer threads is another fine image of what is true throughout the world of life—that one creature is linked to another as if by tendrils.

Who would think that squirrels had anything to do with the success of the harvest ? Yet the riddle is not very hard. It is well known that wood-pigeons do much damage in Europe by eating grain, not only in the harvest fields, but when the seed is sown in the ground. Indeed, a wood-pigeon has been known to collect a thousand grains of oats and barley in its crop in the course of a forenoon. The more wood-pigeons the worse for the harvest. But squirrels have a curious habit of climbing to the wood-pigeon's nest and eating the young ones, so that it is quite plain that the more squirrels there are the fewer wood-pigeons there will be, and, all other things being equal, the better the harvest will be.

No one who thinks at all about the human body, or the body of any complicated animal, can keep back a feeling of wonder. For instance, we cannot help being amazed at the number of different parts in the body, excelling every engine, and at the way they work together. St. Paul was thinking of this wonder when he wrote of " many members, yet but one body," and of members " caring for one another," and of all the members suffering when one suffered. Let us take an example of this great fact of life.

On each side of our voice-box, or larynx—Adam's apple, as we absurdly call it—there is a small body called the thyroid gland, which does not look as if it could be of great importance. Yet it is absolutely necessary for the continued health of both body and mind. If it goes wrong everything goes wrong. Now, what is true of the organs of the body, that they are " tempered together," as St. Paul said, is true also of living creatures as a whole—they are linked together and work into one another's hands.

Who would think that fresh-water mussels were wrapped up in the bundle of life with minnows ? Yet so it is, and in a very pretty way. When the mother fresh-water mussel has young ones—pinhead-like creatures with a bivalve shell toothed at the edge—she does not let them out of their cradle—which is inside her gills !—unless some freshwater fish, such as a minnow or a stickleback, comes quite near. Then she lets them out in an eager, hustling crowd, and they make for the fish like torpedoes, but are able to change their direction as they go. They snap their minute valves and let out mooring-ropes of glue. They fix themselves closely to the minnow and are carried about, and by-and-by, when they have grown and changed a good deal, they drop off, it may be a long way from the place of their birth. It is plain that the race of fresh-water mussels has come to be dependent on the presence of minnows or similar fishes, and it is surely a very remarkable thing that there is a small fresh-water fish called the bitterling—not at all uncommon in some parts of the Continent of Europe—which lays its eggs in the fresh-water mussel. These eggs, thirty or so in number, develop into young fishes inside the gill of the mussel, and take their leave when they are about two-fifths of an inch long. Could we have a more extraordinary illustration of the web of life, of the links that bind one creature to another ? For the mussel needs the minnow, and the bitterling needs the mussel !

THE PIED WAGTAIL THAT HELPS THE SHEEP FARM

All true naturalists, by which we mean those who have keenly, patiently, and lovingly watched the life of living creatures as it is lived in open nature, have had a clear sight of part of the web of life. This was very true, for instance, of Gilbert White, who wrote " The Natural History of Selborne "—a book that lasts like an evergreen. But, of all naturalists, Charles Darwin must be named the greatest, and it was characteristic of him that he had the vision of the web of life in unequalled clearness. Moreover, he helped all the world to share his vision. One of the examples that he gave has become pleasantly familiar all over the world—the case of cats and the clover-crop.

The flowers of the purple clover are visited by humble-bees, who are after their own business of collecting nectar and pollen. The nectar made by the plant is the raw form of honey ; the pollen consists of golden grains which fertilise the possible seeds of flowering plants and start them developing into real seeds. These will by-and-by be scattered and sown, and grow into young plants. The first step is clear ; the more humble-bees the better next year's clover crop will be. But the humble-bees have enemies, and among these are the field-mice, who seek for the bees' nests and devour the bee-grubs. So the second step is clear—the more field-mice the fewer humble-bees. It has been noticed, however, that in the neighbourhood of villages there are more nests of humble-bees than in the open country —a strange fact which is explained by the hunting forays of the village cats, which result in keeping down the numbers of field-mice. So the whole story runs : The more cats the fewer field-mice ; the fewer field-mice the more humble-bees ; the more humble-bees the better next year's clover-crop. And if you like you can go a step farther back in this scientific " House-that Jack-built " story and say : The more kindly old ladies in the villages the more cats, the fewer field-mice, the more humble-bees, the better next year's clover-crop.

That is an old story, but talking of cats suggests quite a new one. The terrible plague in India is caused by a deadly microbe which may get into man's blood if he is bitten by a rat-flea. The microbe lives in the rat's blood and in the rat-flea; and thence, by a flea-bite, it may pass into man. Now, it has been noticed that there is less plague in villages where cats are particularly numerous, for the more cats the fewer rats, and the fewer rats the fewer rat-fleas, and the fewer rat-fleas the less plague. We do not wish to say much about diseases, but they give us many very striking illustrations of the web of life. It is almost certain that the fiery serpent which troubled the Israelites on their desert journey was a parasite called the guinea-worm, which gets into man when he drinks unfiltered water from pools. The guinea-worm spends its youth in a minute crustacean or water-flea bearing the extraordinary name of cyclops—after one of the giants with whom Ulysses contended. Why a pinhead-like creature should bear the name of a giant is a question to which it would be difficult to find an answer. The only point of resemblance is that the water-flea has, like the gaint, a single eye in the middle of the forehead.

Perhaps the most terrible disease in the world is sleeping-sickness, and the microscopically minute animal which causes it is carried from some wild creature to man by the tse-tse fly. So malaria is spread by one kind of mosquito and yellow fever by another. There is no doubt that our common house-flies do great harm in carrying disease-germs about and depositing them on our food. One of the useful things we can do if we grasp the idea of the web of life is to wage war on house-flies and on the carelessness which allows them to multiply near our houses. Their cradles are wherever refuse is allowed to gather and rot. The lesson of the web of life is often severe—a contemptible fly on the wheel may upset a brilliant equipage. For the fly carries typhoid, and whoever thinks of a living creature as trivial because it is minute or apparently out of the swim of things has not begun to learn the lesson of the web of life. If we are to master Nature more completely we must first learn that everything in Nature counts.

THE SQUIRREL DISCOVERS THE NEST OF THE WOOD-PIGEON THAT SPOILS THE HARVEST

The photographs on these pages are by Miss Frances Pitt, and Messrs. W. Bickerton, Charles Reid, and S. C. Johnson.

In the course of ages there has come to be a remarkable hand-and-glove fitness between flowers and their welcome insect visitors which carry the fertilising dust from blossom to blossom. The flowers are often suited to dust their visitors with the pollen; and the insects are often suited to make the most of the flowers. It is not claimed that everything always goes smoothly, for we often see, for example, flowers into which bees have bitten their way so as to get at the treasures of nectar more quickly. This is all right from the bee's point of view, but it does no good to the plant, which may remain unfertilised. Unless there were

A CHAPTER IN THE ASTONISHING TALE OF LIFE

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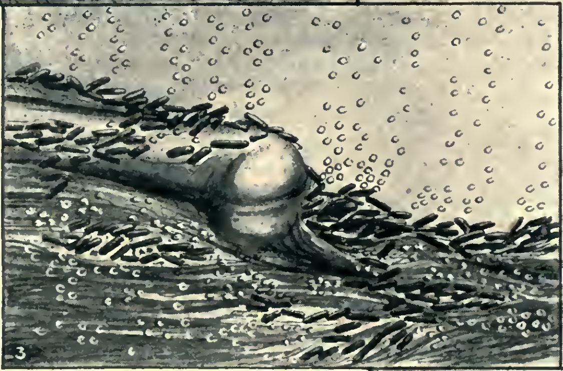
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THERE are not many things more wonderful than the way in which the life of the human race is sustained from day to day. We live by a cycle of Nature which we may divide into seven great steps.

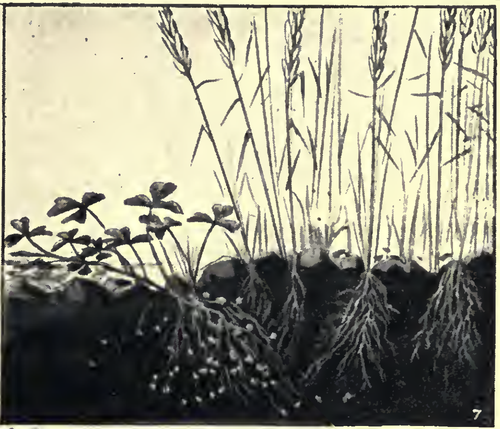
1. The first step shows the seed, packed with the vital force of life, generating the root, which absorbs the elements of soil and air, so building up a plant.

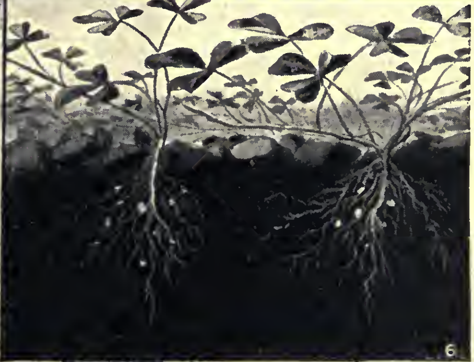
2. The second step shows the animals which live on the plant.

3. The animal dies, and the third step shows the beginning of the marvellous scheme by which the earth wins back for itself the vital force taken from it by the plants. The dead body of the animal is attacked by bacteria, and by other agents of decay, which decompose the matter and convert it into nitrogen, part of which escapes free into the air, while the other part returns to the earth in the form known as nitrites.

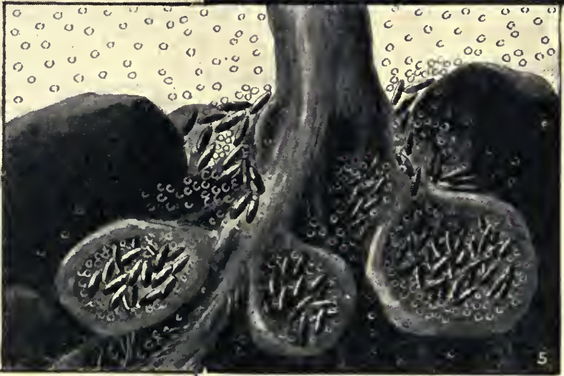
4. Though back in the earth, the nitrogen in the form of nitrites is too simple in kind to be of use to plants; and the fourth step is the appearance of another colony of bacteria, working upon the nitrites so as to build them up richer in oxygen, in the form of nitrates, which the plant can use.

THE SEVEN GREAT STEPS BY WHICH WE LIVE





5. Into the fifth step comes a third colony of bacteria, which recover the nitrogen that escaped into air. This they store in little nodules on the root, where these amazing creatures live.



6. The earth, having now recovered its lost nitrogen, becomes richer in nitrates, and the sixth step shows the plant growing again.

7. But the seventh step is perhaps the most astonishing of all. It explains what the farmer means by rotation of crops. A wheatfield sown with clover one year is richer in wheat the next, because, though the nodules feed the clover, they remain in the soil and give up the vital power to the next crop of wheat.

So, in these seven steps, the cycle of life is complete; from plant to animal and from animal to plant, conveyed by an army of creatures apparently on the edge of the two kingdoms, life runs its circle and upholds the human race. Thanks to these wonderful processes we live; thanks to them we go from strength to strength.

These pictures are drawn to make clear the great idea of what we call the Cycle of Life, and, though they represent actual processes of growth, they are not drawn to scale, and they represent things that are really invisible, such as nitrogen.

other visitors, the trick of biting a hole would soon result in the disappearance of that kind of plant, for there would be no fertile seeds.

Another well-known set of examples of linkages is to be found in the part that various animals play in scattering seeds. Thus a bird—and small animals, too—may collect mud on its wet toes and may carry seeds in the mud from one place to another. Darwin made many observations in regard to the mud on birds' feet, and on one occasion—a fine reward of patience—he actually got eighty seeds to germinate from one clod. Many fruit-eating birds scatter the hard, indigestible seeds, and both earthworms and squirrels sometimes plant trees. Some ants are fond of carrying certain seeds to their nests, and as they do not eat the seeds, but only a "food-body" on the coat of the seed, they may help to extend the range of the plant. In some cases the ants seem to do something to their store of seeds so that they do not sprout; in other cases the ants allow the seeds to begin to sprout, and then chew them into dough and make biscuits of them, which they dry in the sun!

We come across another interesting set of inter-relations in galls. Many of these are formed round about the grubs of gall-flies, just as some kinds of pearls are formed in bivalves around the young stage of a parasitic worm. It seems that the ferments which come from the mouth of the gall-fly larva irritate the adjacent parts of the leaf or twig, and provoke the strange growths which take so many different forms. In some cases there are moulds and the like introduced along with the eggs of the gall-fly, and this complicates matters. So often it is that there are wheels within wheels.

Another way of getting a glimpse of the web of life is to select some particular kind of animal, and inquire into the other lines which its life touches. Let us take earthworms, for instance, which might seem rather detached creatures, as they live underneath the ground, and if they are in good health do not show themselves on the surface until night falls. It is very likely that their ancestors lived in fresh water, and that it was only in the course of time that they discovered the underground world. For a while they must have had a golden age free from enemies, but it was not to last for ever. The centipedes, with their poisonous claws, appeared on the scene and pursued the earthworms down into their subterranean retreats. They have never ceased to harry them, and some of the carnivorous beetles followed suit. Long afterwards the birds learned to watch for the appearance of the earthworms in the twilight, and to catch them in the early dawn as they were returning to their burrows. The saying "The early bird gets the early worm" is not quite good natural history. It should rather be "The early bird gets the late worm," the worm who stayed out too late and wouldn't go home till morning. Besides the birds there are the moles, who follow the earthworms beneath the ground. Even in the winter-time they continue their persecution, going deep below the grip of the frost's fingers. Though some have thrown doubt on it, there is clear evidence that moles sometimes make a store of earthworms near their nest, and bite off the heads of their prisoners so that they are unable to crawl away. There is something rather horrible about this living larder; it has its parallel in the stores of caterpillars, grasshoppers, and the like, which some mother wasps collect for their young ones. They sting their victims so

THE STOAT ALERT

THE FERRET AND HIS PREY

that they are paralysed and cannot creep away. But the point now is simply this—that the life-circle of humble creatures like earthworms intersects the life-circles of centipedes, of some ground-beetles, of birds, and of moles, and of many other animals besides.

In the same way, if we take the white ants, or termites, of warm countries we find that their life-circle cuts into that of many other animals. Thus in Africa, where the termitaries, built of chewed earth, are very common, we find a multitude of inter-relations. We picture the quaint aardvark, one of the ant-eaters, a relic of bygone days, who comes at night to break into the ant-hill with his strong claws, and, having made a big hole, whips the termites into his mouth with his worm-like, sticky tongue. At the other end of the scale, there are within the termitary guest-beetle intruders, who are tolerated, apparently, for the sake of their strong scent. Again, there is the extraordinary habit the termites have of making out of chewed wood a sort of mazy framework, in the passages of which they grow moulds, just as we might grow mushrooms. Very interesting also are the occasional collisions between the termites and the true ants, who are insects of much higher degree. A naturalist, working in Ceylon, once saw a band of the large tailor-ants attacking the small, black termites when these were gathering lichen from the trees. The worker-termites are always accompanied by a guard of soldier-termites, who do not share in the collecting. In the case of the Ceylon black termite, the soldiers have very small jaws, and the observer watched with great interest to see how they would meet the tailor-ants, which are three times larger and much nimbler. What happened was really extraordinary. The soldier-termites squirted into the faces of the tailor-ants a juice which seemed to drive them almost crazy. They retreated as if in pain, and continued for a long time rubbing their faces on the ground. It was a case of injury added to insult! Are not the threads of the web of life sometimes strangely tangled?

THE TERMITES OF WARM COUNTRIES THAT BUILD ENORMOUS STRONGHOLDS AND LOYALLY DEFEND THEM

We have taken two examples—earthworms and termites—but we might take two hundred, for there are few creatures that can be thought of as living detached lives apart from their fellows. Gilbert White was right: "The most insignificant insects and reptiles are of much more consequence, and have much more influence in the economy of Nature, than many people are aware of." But we cannot pass from earthworms and termites without remembering how much both have meant, and still mean, not only in Nature, but to Man and his needs. For the various kinds of earthworms distributed over the greater part of the world, except in very dry places, very wet places, and meadows within reach of the spray of the sea, have made a great part of the fertile soil of the globe. Their scarcity in many parts of Canada, including some places with fertile soil, is probably due to severe thinning in the Ice Ages, when glaciers stretched over a large part of the country. Ploughers before man, the earthworms are always turning the soil round, bringing it to the surface in castings; with their burrows they loosen the ground and make way for the plant-roots and the rain-drops. They are continually taking leaves into their burrows, thus furthering the formation of vegetable mould. As Darwin said, "It may be doubted whether there are many other animals which have played so important a part in the history of the world as have those lowly organised creatures." As for the termites, they are in many ways great hindrances, for while it is good that they should prune off the decaying branches in the forest, it is less agreeable to us when they tunnel out the legs of tables, eat the bindings of books, take the corks out of bottles, and destroy telegraph posts. In some places we are told that "if a man lay down to sleep with a wooden leg it would be a heap of sawdust in the morning." On the other hand, they keep the soil circulating, as earthworms do, especially when they make tunnels of chewed earth to hide themselves from the light. They destroy rotting things; they make for cleanliness; and they are sometimes eaten.

THE MINNOWS THAT GIVE THE MUSSEL A RIDE

THE STICKLEBACKS THAT GIVE THE MUSSEL A RIDE

THE BITTERLING THAT HIDES ITS EGGS IN THE MUSSEL

A wonderful example of the Web of Life are these tiny creatures. The baby mussel needs a carrier to take it to fresh feeding grounds, and the bitterling needs a place to hide its eggs in. Well, the bitterling lays its eggs in the mussel, and the baby mussel rides on another fish, the minnow or the stickleback, out to the fresh waters. We may say, perhaps, that one great branch of life, the invertebrates with no backbone, does a good turn for the other great branch, the vertebrates with backbones, and that the vertebrates pay them back again.

It is a study by itself to show the manifold ways in which living creatures effect changes on the earth, and on other circles of life. Many minute animals, related to sea-anemones, with hard shells of lime, have formed coral reefs and coral islands. Many much smaller animals have helped in making chalk cliffs. Beavers have cut down forests and altered the course of rivers; water-voles undermine the banks of the streams. Several kinds of shore animals bore into the solid rock, and there is a common sponge of small size that crumbles thick shells into sand. The forests affect rainfall and climate; the grass protects the earth like a garment; the bog-mosses on the moors form huge sponges that keep the streams flowing in days of drought. Indeed, there is hardly any kind of plant, from the lichen on the wall to the cedars of Lebanon, that is without its influence upon the earth; and this is another aspect of the web of life.

There is no doubt that Man wishes to master Nature, and make the most of Nature. If he is to succeed he must respect the web of life. He must learn, as in a game of chess, to look ahead when he makes a move, for it is not only the immediate consequence that counts. For instance, he must be very careful in introducing animals or plants into a new country. The thoughtless introduction of rabbits into Australia in 1860 has been one of the most wasteful of mistakes. Away from their natural enemies, the rabbits multiplied into a plague, and turned great tracts of smiling fruitfulness into heart-breaking deserts. About a dozen times a similar mistake was made in introducing British house-sparrows into the United States. They have become a national pest; they have wasted millions of dollars; they have driven useful and more interesting birds away; and all because Man, without thinking enough, disturbed the balance of Nature, and introduced foes into his own household. Similar introductions of insects and weeds have had most disastrous consequences.

Wherever our ships have gone our rats have also gone, and they have established themselves almost all over the world. Into Jamaica, for instance, they were unconsciously introduced, and became a pest. One of the devices employed in the hope of getting rid of them was the introduction of the mongoose from India. This alert carnivore is very clever in destroying snakes, crocodiles' eggs, rats, and much more. It was half domesticated by the ancient Egyptians, and it has often proved itself of great service to Man. Taken to Jamaica, it set to work in its usual vigorous way, and there was a general clearance of rats. It also turned its attention with good results to the native rice-field mouse.

The Mongoose that Came to Jamaica and Gobbled Up Friends as well as Enemies

People were very much pleased with the mongoose; but, unfortunately, there were by this time a great many of them, and they had to be fed. They turned their attention to poultry, to ground-birds, to snakes, and to lizards; and it soon became very plain that there were two sides to the mongoose account. Several kinds of lizards were quite exterminated, and some useful birds became rare. As the result of this, the injurious insects and ticks that the birds and lizards used to keep in check began to gain the ascendant. It is now said that the increase of ticks is making life a burden to the mongooses. In the course of time a balance is arrived at in all these cases, but there is often terrible wastage before things readjust themselves. Not all the king's horses nor all the king's men can bring back an animal which has been exterminated.

What has been said in regard to careless introductions applies also to reckless killing. Thus in Britain and in many parts of Europe there have often been terrible plagues of voles, or field-mice, which have resulted in the devastation of hundreds of thousands of acres of cultivated land, even the grasses being so thoroughly devoured that the ewes could not give milk to their lambs. There is no doubt that these vole plagues are in part due to the extermination of the natural enemies of the voles, such as owls, kestrels, buzzards, rooks, stoats, and weasels. It is also probable that what is called grouse-disease is due in part to the over-shooting of birds of prey, for they are to some extent useful in keeping the grouse in vigorous health by cutting off the weakly birds. On the whole, the birds of prey sift out those of feeble constitution, and there could be no greater kindness to the race of grouse.

The Little Bit of Good to be Said for the Bold, Bad Rat

Taking a broad view, we cannot feel very enthusiastic over house-flies, house-sparrows, wood-pigeons, rats, and some other creatures—not very many—which must be put on a sort of " black list " because they do so much harm. But no naturalist is ever confident in regard to wholesale massacres. They are so contrary to the general procedure in Nature that we distrust them. To take an example, there is much to be said against the common brown rat, for it is bearer of certain dangerous diseases, which it spreads; but it is to be remembered that the rat is almost omnivorous, and that while it eats up valuable stores it is also a scavenger, clearing up odds and ends of refuse. It is quite possible that a well-organised universal massacre of rats in a country might mean " a good riddance," but, unless this were followed by a great improvement in the way of disposing of waste, we might soon be wishing the rats back again. For it is not easy to keep the world clean without the help of Nature's scavengers. It ought to be a law, like to a law of the Medes and Persians, that no kind of living creature is to be destroyed unless it is quite certain that its disappearance will not be followed by results worse than those due to its presence. Many humble creatures play a very important part in cleaning up things in the household of Nature.

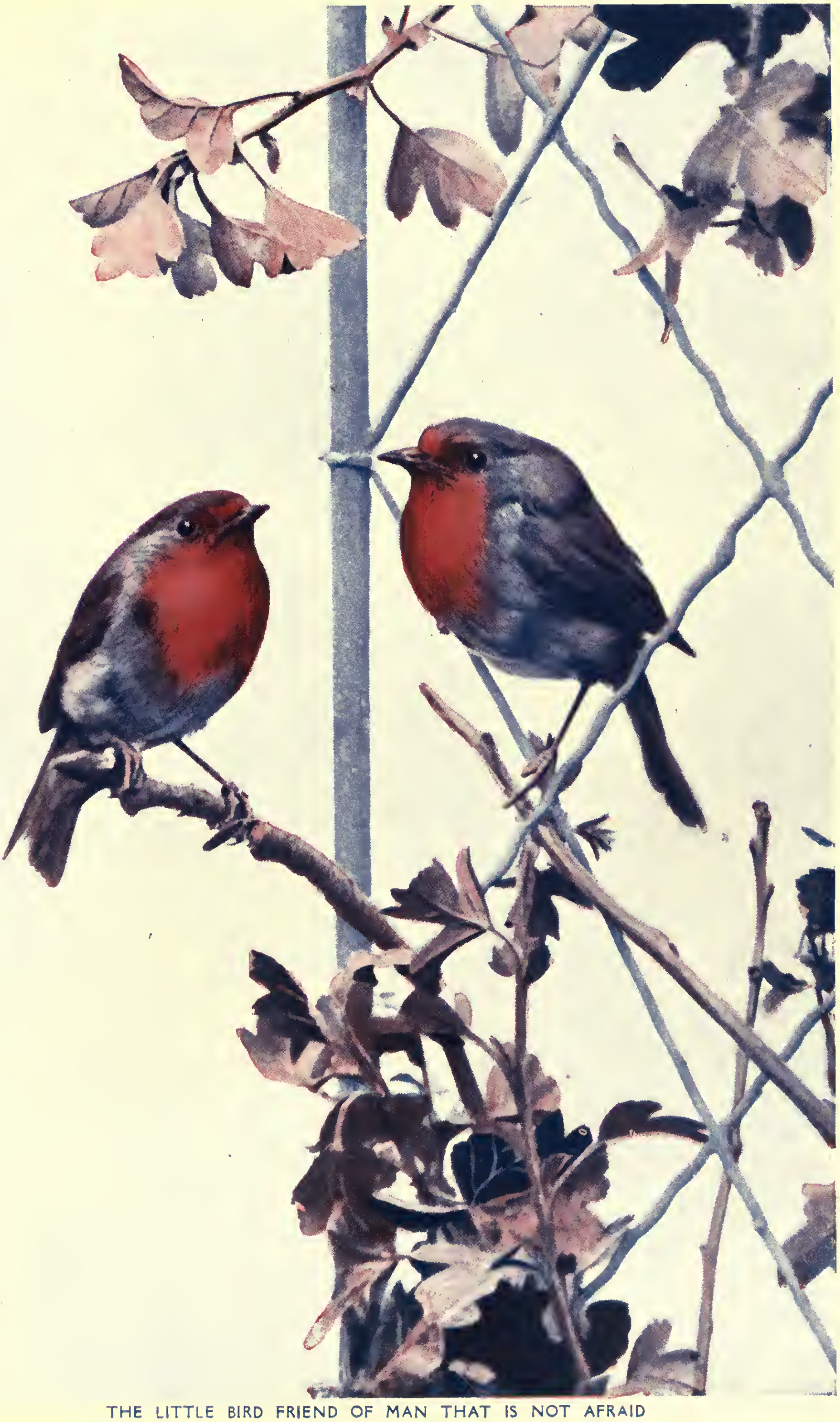
How Somebody Blundered in Australia and Spoilt the Fishing

There is a very instructive story about cormorants in Australia, which shows the danger of hasty orders, especially when these mean killing. On some swamps of the Murray River, and on certain lakes, there were huge numbers of cormorants. With the desire of improving the fishing, orders were given for a massacre of these birds. For the places mentioned were spawning-grounds and nurseries of various food-fishes, and the idea was that the cormorants—well known to be voracious—were destroying too many of these. The numbers of cormorants were reduced to one-tenth of what they had been—a terrific slaughter. But the fishing became worse, not better! And then, too late, it was discovered that the fish spawn was devoured by myriads of crabs and other crustaceans, by turtles, and by eels and other fishes, and that the cormorants fed very largely on two of these enemies of the spawn—namely, the crabs and the eels. The massacre of the cormorants thus meant an increase in the number of the spawn-eating crabs and eels. This could have been found out by a little careful investigation, and a big mistake might have been avoided. When it is proposed to try to control Nature in a severe sort of way, by cutting down this and lopping off that, the first step to be taken is to make a careful and unprejudiced study of the Web of Life. A bird cannot fall to the ground without sending a throb through a wide circle. In a woven fabric it does not do to begin pulling threads out, and the world of living creatures is in this sense a web.

We must not fancy for a moment that even the greatest naturalists have ever seen the whole web of life as it is at present before us, or all the pattern which it displays. The fact is that only a few parts are as yet clear, and it is the possibility of discovering more pieces of the pattern that makes natural history so fascinating. Moreover, the pattern has not always been what it is to-day; it has slowly changed, age after age, and that is what is called Evolution. It seems certain that the pattern has, on the whole, become finer and finer as the ages have passed. It looks as if more and more threads were being caught up together and intertwined, for the weaving of the web is going on, and we are sharing in it.

THE RABBITS THAT HAVE OVERRUN AUSTRALIA AND PLUNDERED THE CROPS OF THE WHOLE CONTINENT

ROBIN REDBREAST TALKS THINGS OVER



THE LITTLE BIRD FRIEND OF MAN THAT IS NOT AFRAID

ROBIN REDBREAST

WHY DOES HE HOP TOWARD US IN THE GARDEN WHEN THE OTHER BIRDS FLY AWAY?

THE LITTLE WILD FRIEND OF MAN FOR THOUSANDS OF YEARS

EVERY garden has its song today, for robin is at home. He nearly always is, and nearly always he is singing.

But just now his notes are fuller and richer and more glorious than ever. He is singing as if to tell us spring is at hand. It is a gay, glad note that he pipes today ; it is more subdued in winter, unless the sun is up and out and all the air is alight with splendour. So writes an English bird-lover about the European robin—perhaps the most famous and certainly the best-loved wild song-bird in the world, not excepting the nightingale. It is a little bird, like one of the American summer warblers ; but on account of its reddish breast quite a different and much bigger bird has been called "robin" on this side of the ocean. The *robin* of this article is a little migratory red-breasted warbler of Europe, and it is described by one who knows it in his own British door yard.

He is the friend of everyone who loves a bird ; he seeks to be the friend even of those who do not love birds. There are thousands, let us hope millions, of robins in the country, but there are robins in the towns and cities. The poorest little garden which has a worm, or an insect, or a few crumbs scattered by a kindly hand, has its robin, too. We never love the robin as much as we should until there comes a danger of our missing him. There went to London, not long ago, a man who had spent golden years in the country, who, among other lost delights, missed the company of the birds. It was winter-time, when even the few singing birds that remain in England are hushed to silence. The air seemed sad and silent to this man back in town from the country. But very early one morning, as he drew back his curtains, there came a sudden burst of melody outside his windows, and a dear little robin fluttered to the casement, singing, it seemed to the man, as never bird had sung before. The sound of that robin's morning hymn, thrilling out in the London air, was like melodious gold to the ear of the man who listened, and he felt for the first time the real *meaning* of that love we all have for the robin above every other bird. For there is this beautiful fact in the behaviour of the robin, that, whereas nearly every other wild bird flies in terror at our approach, *Robin Redbreast flies to us!*

All wild animals, from elephants and lions down to the mouse and the mongoose, have learned to fly from man. In the long ago men and animals were at war. Flesh-eating animals, when they caught human beings, ate them, as they still do in times of privation. Men, when they could, caught, killed, and ate animals. They caught and killed and ate birds, too. And so thousands of years of experience taught animals and birds to fear men. They became more and more alert in avoiding us, in hiding their nests from us. Where they did not protect themselves in this way, they let their wings die away, so to speak. They forgot how to fly, and, like the great moa, the dodo, the solitaire, and other flightless birds, they paid for the neglect with their lives.

Practically all the birds that trusted men have perished, or are perishing, unless, like the ostrich, they have been domesticated. In most cases they had to make themselves ready to fly fast and far before us. And yet, in spite of all the warnings from the fate of other birds, robin makes friends of us, comes to meet us in the garden, hops expectantly about us as we walk ; comes to us, not because he actually knows us, but because he insists at first sight on making friends with us.

When a certain small girl and her cousin gave a luncheon party in a little house in a garden, Robin Redbreast was the first guest. He flew into the bushes, popped through the back window, and had lunch as they cooked. He was a complete stranger to them. Probably he had been reared in the nest which two robins had built in the cage in which a dormouse had made his home. But they did not know this bird He knew them, and that was enough; and, while they cooked the vegetables and meat and soup and sweets in their toy kitchen range, he was here, there, and everywhere, tasting and testing, with his handsome little head cocked wisely to one side, as if he had been all his days testing and tasting in the best hotels, and had come now to give them the benefit of his experience.

Now, although we are all so accustomed to these friendly advances of the robin as not to take any notice of them, there is really a great mystery in the matter. Why should Master Redbreast come to us while other birds fly away? We can only guess at the reason. Many minds have pondered the problem, and the explanation at which they have arrived is a romantic and charming one. The beauty of robin's plumage and the charm of his song attract the affection of everyone who cares for a handsome bird and good singer, and it is thought that perhaps our savage ancestors, who dwelt in caves, were attracted, as we are, to these glorious little birds, and that, whatever may have been their attitude towards other birds, they spared their robins. We know that they ate multitudes of birds, for we find their history books in the form of great refuse heaps—heaps of cinders and refuse of the food they ate. We find bones of the horse, of cattle, of dogs, of animals no longer seen in England, or indeed in Europe, all buried in what we call the kitchen middens of the primitive men; and with these remnants of bygone feasts of savage days we find the bones of hosts of birds. Our savage forefathers, then, were bird-eaters.

But, we say, this habit of the robin in fearlessly making friends with us proves that for thousands of years it has enjoyed the protection of man. A poisonous snake, the very moment it is hatched from the egg, rears its ugly little head and seeks to bite the hand of a man it has never seen before. Snakes and men are always at war, and the young are born with the fear and hate of men in them. But the young robin, like the old robin, shows an instinct for friendliness with man.

ROBIN IN THE SNOW

This kindly and fearless regard for man, then, must be inherited. Robins fly from a cat as other birds fly, showing that they inherit a fear of that enemy. And, of course, they will not—except very rarely—let us touch them. But they will fly to us, and perch upon us, and dash into the house and peck from the table. That is the great difference between Robin Redbreast and other birds. Therefore, as it takes a long time to develop a new instinct in a bird, we may be sure that robins have for a very great time been in the habit of flying towards men, and of visiting their habitations. Observers of birds and of men, who have studied the history of both, think that, in the old days when our forefathers lived in caves, the little robins of those days were in the habit of flying in and out of the caves, and all the theories that have been examined suggest that the robin, who is really a very ancient Briton, was in the habit of associating with the men of this country long before Saxon and Norman and Dane, or even before the Romans, were known in the land. They were friends with our savage ancestors, as they are friends with us still.

We have said that the robin sings all the year save when he is moulting. Now, that leads us to another mystery. The robin is a shamefully misrepresented bird. They say he is a quarrelsome bird, and that the young, as soon as they grow up, attack and kill their father. Now, it is true that robins fight, as other birds do, but it is not true that robins are specially wicked, or that the general practice is for young robins to kill their father. The trouble arises after the moult, when the robin's song ceases. The robin rears two, three, or even four nests of young ones in the course of the summer, and then, when he has splendidly discharged his duties as a parent, toiling from sunrise to sundown, fetching and carrying food for his babies and seeing them safely from the nest — then, with his feathers frayed and worn, he retires to the solitude of the thick copse, in order that he may rest and change his feathers undisturbed. Other birds do the same thing, and we foolishly say, you will remember, that the male peacock is so vain that he hides away while the change is taking place, in order that he shall not be seen in undress uniform. No bird is at its best when moulting. It must have seclusion from its enemies. Crabs and lobsters in the water hide when moulting their shelly armour, stags hide while their antlers are growing, and birds retire at moulting time in order that they shall not be taken at a disadvantage. Robin, then, simply follows the common rule.

THE LITTLE FRIEND IN THE GARDEN

Now, the father bird, at his retirement, is lord of a little domain of his own. There is no doubt that each pair of robins has its own kingdom, and they are proud and happy for their young ones to share it for the time being. But, by the time the father bird has cast his old feathers and put on new ones, the young have taken possession of the home. They feel that they, and not he, ought now to rule. Father Redbreast comes out of hiding, no doubt, full of song and good resolutions — one resolution being to live as he was made to live, by diligently seeking food in his kingdom and so preparing himself for the duties of another nesting season; but the new rulers of the home resent his coming, and the fighting begins. The battle may be renewed from time to time during several days, and sometimes death results, but it is not, as a rule, the son which kills the father. The bird which is strong enough to have won for itself a mate and to have battled through the perils of the nursery is generally a bird in the prime of life, and therefore much stronger than the nestlings of the year, and if death does result from these battles it is likely to be a weakling son who will fall. But let us not imagine that the result is generally of that kind. As a rule the vanquished take their departure, and so obey one of the unchanging laws of Nature, to go forth into new areas, there to flourish and multiply.

It is one of the laws of Nature that all warm-blooded creatures—and some cold-blooded creatures, too—protect their young as long as protection is needed, but that, after the help of the parents becomes unnecessary, the young are driven away to find homes for themselves, and that is precisely what happens among the robins. Perhaps it may even be all for the best that robins fight and scatter, for if they did not there would be scarcely a robin left in the land in a very few years. Where there is plenty for two or three or four robins, there is only starvation for ten or twenty times that number. If two robins can get a good living in the autumn, and just scrape through the winter, it is obvious that if all their young ones remained to share the same food they would die.

Let the fate of the lemmings, stupid little animals, illustrate the point. These rodents are accustomed to collect together in colonies, where, with a favourable early spring, they multiply enormously. Hot, parching summer comes, destroying all vegetation. There might still be enough

LITTLE ROBIN REDBREASTS READY TO LEAVE HOME

The photographs illustrating this article are by Oliver Pike, Charles Reid, R. B. Lodge, and others for a few lemmings, but there is nothing for the multitude, so out they march on those so-called migrations of which we have all read. It is not a migration at all: it is simply a march to death. They blunder blindly on in a straight line until they are eaten by enemies, or until they drop dead of disease or starvation, or until they reach the sea and plunge helplessly into the waves to drown.

The robins that are vanquished in these fights are not generally killed. For robins to battle to death is an exception. We make a mistake in saying that robins do not migrate: they do. Robins in the South fly farther south; robins in the North, where the summers are short and the winters long and severe, come south to take the place of those that have gone. Those nearest the coast, if they are south, fly out over the sea. This fact has been revealed to us unexpectedly. Storms have brought great flocks of birds to the ground, wounded and disabled and forlorn, and among them have been found flocks of robins, carried in from sea. They must have set out on their migration, and been driven by stress of weather to land at points which they had clearly not set out to reach.

Those which fly from north to south of our land share in a general movement of birds well known to take place at that time of the year. What does it mean? If those already in the Midlands or in the South have to fly away because they find food insufficient, how is it that other robins coming from the North are able to make a living in the places that have been deserted for this very reason?

Here is a mystery indeed, which we can only wonder at and try to understand. The struggle for existence among robins does not confine itself to battle and murder and sudden death; it is like the struggle for existence which goes on among men in great cities. Men so placed do not battle with hand weapons, yet they are competing for very life one with another. We hear that men sink under the burden of competition; they are driven by stress of circumstances to pack up and go to other places. If they do not, they stay and starve. The same thing happens in the case of the robins. Without a single fight they may have to flee. Nature teaches them that they cannot stay and live where robins are many. They must scatter. Perhaps it may be that instinct helps them to realise, with the changing condition of the year, that their kindred from the North will be drifting south, and that they too must move on, or perish.

THE SINGER IN THE SNOW

We are told by careful observers of robins that these birds were once as truly migratory as the swallow and the nightingale, but that thousands of years of friendship with man has enabled the old birds, at any rate, to pass the winter where they have passed the summer. How are we to account, then, for the movements of the young ones, which seem to migrate while the old ones stay at home? The belief is that there is truly the old instinct for migration in the young bird, and that when it is compelled to leave its birthplace it moves on, with the other birds, to another place for the winter, and that in the summer it may return to make its nest where it grew up. Then, when it becomes a householder, with a settled interest in the place, the migratory instinct leaves it; it becomes a resident, and leaves migration to its sons and daughters and nephews and nieces. In that way father may in time yield place to son, daughter may succeed to mother. The little robin which comes flirting up to us

ROBIN REDBREAST AT LUNCH ON A COCOA-NUT

as we walk into the garden may have ancient ancestral associations with our house and grounds. Scores of generations of that robin's family may have been there, seeking and making homes in scarecrows, in old tin cans, in ancient boots, in discarded hats, in broken lanterns, and in the thousand and one other odd places in which these incomparable little birds are cradled.

Death is frightfully busy in the family of the robin. There is the sad tale of natural death; there is the appalling chapter of accidents; there is the dismal story of little birds which fly away never to return; there are biting frosts which make the ground as iron and starve our little beauties; and there are a thousand and one other causes all helping to thin out the population of robins.

A ROBIN'S NEST IN A KETTLE

So, although his numbers are happily always sufficient to make him one of the commonplace friends of our home, there is a sadness and mystery about the robin. He is part of our country life, part of our town life, our one almost unfailing chorister when all other birds are sulky and, sad when the year is tottering to its close, when the trees are gaunt and bare, when all Nature seems gloomily entranced save in his cheerful throat. Poets love the robin, so do makers of fairy stories and of nursery rhymes. Who has not felt sad with the little feathered mourners, as

The birds of the air fell a-sighing and a-sobbing
When they heard of the death of poor Cock Robin?

And whose heart has not been stirred with affection for the little redbreasts which tenderly brought the leaves to cover the lost Babes in the Wood? Some of the tenderest traditions in our language have been woven about the beautiful ruddy robin One story is that, moved to pity for the anguish of Jesus on the Cross, robin sought to remove the crown of thorns from His brow, and has ever since worn a red breast in token of the wounds it sustained in the task. Wherever the robin lives we find pretty legends concerning him, and the charming thing is that all these legends recognise the friendship of the little bird for man. The alert good-humour with which he springs from hiding, and boldly flits towards us in our own garden, is characteristic of the robin wherever he is found. It may be nothing to us, yet it has served poets and writers for some of their most charming work.

But nothing that has been said or written concerning this little king of our gardens and alleys and courts is half so charming as robin himself and his unfailing friendship for man, the one creature whom all other forms of wild life fear. Let us reward him, then, for his fidelity by seeing that, when hard days come, he has that little bowl of food and drink which is the only return we can make him for thousands of years of trust and confidence in us, denied to man by all other forms of wild life.

THE LOVELY CREST OF AN EASTERN BIRD

THE MOTTLED CREST-FEATHERS OF THE GREAT EUROPEAN BUSTARD

THE FLYING KINGS

THE FEATHER YOU PICK UP IN THE STREET—THE CROWNING MARVEL OF THE AGE OF FLYING AND WHAT WE OWE TO IT

THE MILLION-YEAR-OLD STORY OF A MILLION THINGS IN ONE

When snowflakes fill the air we say that the fairies are plucking their geese and the feathers are coming to earth. It is a child's pretty fancy, but it is true in the autumn that feathers are flying about, for myriads of birds are moulting, as we say. They are putting off the gay and gallant costumes in which they went courting and marrying and bringing up their little ones, and are putting on sober garments of winter. The new garments will, in most cases, have to last until spring, when new colours will appear, as if Nature, proud of her children, had dipped her brush in the rainbow to paint them all anew. There is one of the greatest wonders in a feather.

We are so used to the sight of birds that we forget how marvellous they are. We take them for granted, like the bloom upon the peach, the enamelled splendour of the buttercup, the matchless sweetness of the honeysuckle's perfume. There is in the feather of a bird that which leaves the wisest men guessing. We know from what it comes, but we do not know how it has been formed.

Long, long ages ago Nature took a reptile family, whose members had feet and "hands" like those of the crocodile and lizard; she joined the fingers of the hands together by means of a leathery fold of skin, which formed an attachment, finger to finger, and from the arms to the sides of the body. And those reptiles flew, much after the fashion, we suppose, in which bats fly today. She fitted up insects with gauzy, filmy wings, and they flew. But still the perfect type had not been reached. Mother Nature went to work again with reptiles. She changed them from cold-blooded creatures into hot-blooded creatures, and out of their scales she wove feathers!

How she did it we do not know. Some day, when we dig deeper into the earth, we may know; or perhaps we may never learn the secret. The first bird-like forms may have arisen in lands that are now beneath the ocean. The remains of the animals that first became birds may be buried deep beneath those drowned lands once connecting Australia with America or Europe with Africa.

The first bird-forms may lie hidden down there, or may be deep in rocks into which men have not penetrated. Somewhere down in the rocks, or in deposits under the water, must be outlines of creatures once half bird, half reptile, for the first of the bird race that we know is of a type much too advanced to be the earliest. That is the archæopteryx, a hard name meaning simply "ancient wing." That creature, found in the rocks, had, when it was alive, a long, fleshy tail, made up of twenty-one vertebræ-bones like those of the backbone. The great majority of birds have tails, but in every living example today the tail is simply of feathers springing from a fleshy stump in which are concealed two or three little vertebræ. The ancient bird of which we are thinking had this long tail of flesh and bone, like the tail of a reptile; but here comes the wonder—that old-fashioned tail had the newest thing in coverings. It had feathers! The mysterious change from scales to feathers had been already worked out in those reptile bird-forms which we have not been able to discover.

We know that Nature never makes a sudden leap from an old form of life to a new. She works gradually, completing a detail at a time, and she must have taken ages to change scales into feathers. So, when we find the first known bird, embedded in the rocks, with the outline of its feathers clearly showing, we know that we have here not actually the first of the bird family, but only the first that we can trace. He will be a proud and happy man who finds the fossil which reveals a form of covering between the scales of a reptile and the feather of a bird.

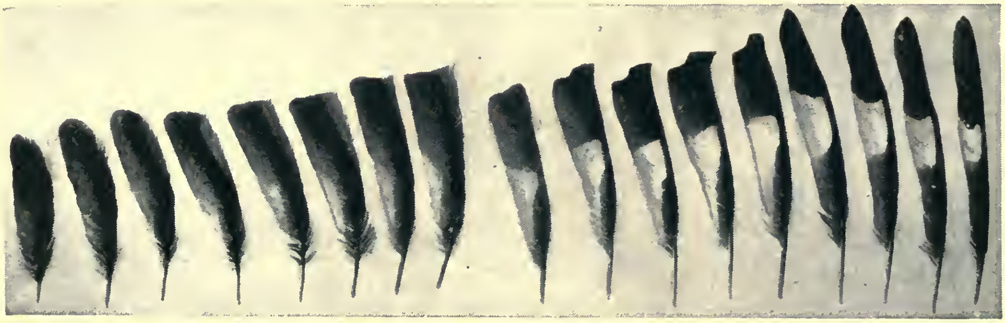
For the feather represents one of the most astounding changes effected in animal life. It means more than a covering of the body; it means more than flight; it means more than ornament.

We know that bats can fly without feathers; certain frogs, mice, lemurs, and other animals perform a sort of parachute flight without feathers or even wings. But to birds are given powers higher than the powers possessed by these animals. If a bat sustains an injury to the membrane by means of which its hand and arm are converted into wings, the bat is unable to fly; it is helpless. But many feathers may be damaged or even destroyed without seriously checking the flight of a bird. Feathers are the crowning invention of Nature for the mastery of the air.

Like the silk which the spider and the caterpillar spin, a feather is one of the strongest, yet one of the lightest, things in the world. It does for the bird what the engineer is trying to do for the aeroplane—it gives the greatest strength and carrying power for the least possible weight.

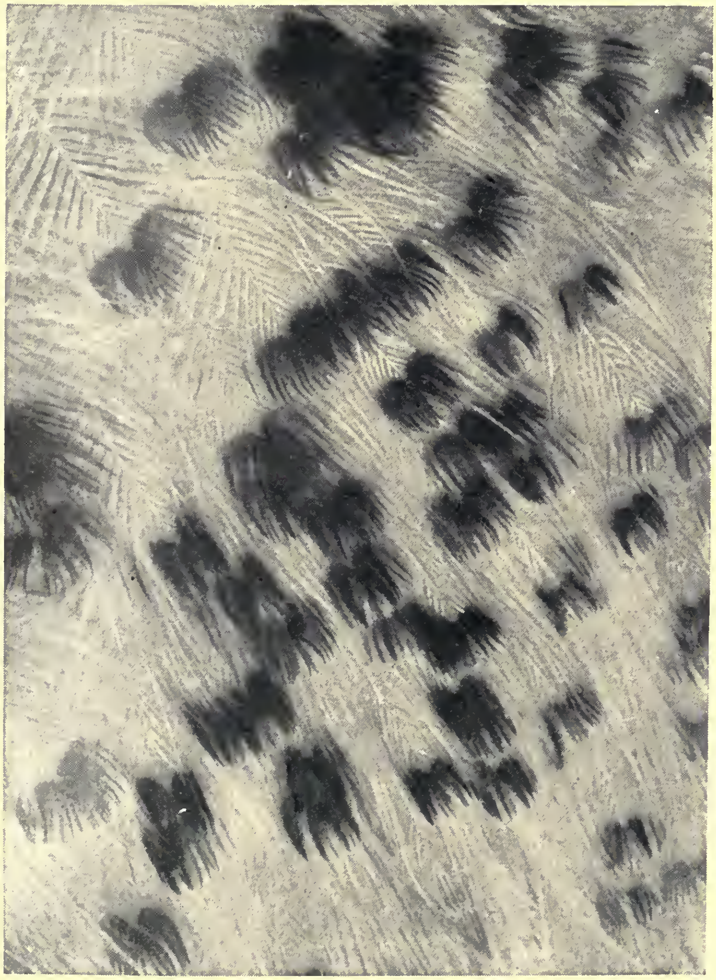
What builds up the feather? Set before a bird a mess of worms or ants or caterpillars, a meal of fish, or a bowl of seed, and, by one of the most marvellous processes in Nature, that fare will be converted into the various things that make up a bird's body and covering—into blood so hot that, were it in the veins of a human being, it would cause raging fever and death; into muscles proportionately greater than those which enable a lion to strike an ox dead at a single blow; into the same mechanism that made the first music ever heard in the world; into feathers that carry a bird up to heaven's gates, keep it unharmed upon the ocean in storms in which steamships founder, float it unharmed to heights in the air where men can scarcely breathe, keep it warm and comfortable through the awful darkness and cold of the long Antarctic winter where not even ice-haunting plants can live, and protect it not only from cold such as this, but against the perils of heat which cause men to drop dead of sunstroke.

If there were no feathers there would probably be no men or women or children. Feathers are the clothes which keep birds alive through the cold days of winter. Lacking feathers they would die, as the unthinkable hosts of insects die each winter. That would remove from the earth the greatest natural protectors we have against the insects that devour our crops. An insect hatches, it is true, in the late spring, from an egg laid in the previous year, or from the chrysalis in which it has spent the winter. But it would bring immediate disaster if the birds passed through the same process. We need the adult birds most just when the new swarms of insects are appearing, or our enemies would get such a start that they would become a plague beyond the power of man to check. And, just when the insects are increasing their numbers, the old birds have babies in their nests, and are at work, from the rising of the sun to the fall of night, gathering insects, insects, insects beyond number for the hungry babies in their cradles. Of course, the young student who thinks of the migration of birds will answer that hosts of our feathered friends leave us in the winter. That is so, but without feathers they could not do so. They would be left helpless here, without food, to die. Feathers carry them over the sea to safety, to abundant food in lands where they help by their search for sustenance to keep down the insects there. It is calculated that, if all our birds were suddenly to die, insects would multiply to such an extent that in the course of a few months they would eat every green thing off the face of the earth, and bring death to man and beast. That is a tremendous thought to associate with the study of a feather. The feather which at first sight is of



THE FEATHERS OF THE WING OF A HAWFINCH, SHOWING THEIR DIFFERENT SHAPES no interest to us is the greatest natural safeguard we have against death as certain and terrible as that inflicted by a merciless army of soldiers upon a besieged and foodless city.

Can you describe a feather? Can you say what it is, of what it is formed, how it is built up? It is at first sight as simple as a sunbeam—and, in its way, as marvellous. For all its seeming simplicity, a large feather is made up of a million parts! With that startling fact in mind we may approach the study of a feather. There are several kinds of feathers. There are the big, powerful feathers which serve to carry the bird through the air; there are the feathers which form the outer covering of the bird's body; there are the downy feathers which serve for warmth and coolness — warmth by preventing the heat of the bird's body from escaping; coolness by keeping the outer heat of the air from striking into the flesh of the bird. Then there are feathers which are scarcely feathers at all, which seem more like hairs, which are called filo-plumes, and are always seen remaining upon the body of a bird that has been plucked. When the cook " singes " a bird, it is these filo-plumes which she burns off. They are really tiny feathers which never grow up, and we do not clearly understand their purpose. Also there is a peculiar small feather, a true feather growing out from a larger true feather, and called the after-shaft—a smaller edition of the big feather, like an offshoot growing from the trunk of a big tree. As there are several different kinds of feathers, so, of course, there are many different sizes of feathers, from the powerful flight feathers — the primaries and secondaries, as we call them—down to the little feathers which spring from the base of the beak and range over the head and neck.



THE LOVELY BREAST FEATHERS OF A THRUSH

Each different kind of feather has its purpose; so has each size. The difference in size is necessary so that the body of the bird may become a beautifully-modelled mechanism. As all must be equally covered, smaller and larger feathers have to be employed so that a smooth and finished effect may be gained, an effect which lends symmetry of outline and least resistance to the air through which the bird has to fly. We do not realise how perfect is the arrangement of the feathers until we see a bird which has been in the wars and has the ends of one or two feathers pulled out of place. The effect is to make the bird look extraordinarily untidy, and to cause the disturbed feathers to act as a brake, so retarding the progress of the bird. The whole arrangement of the feathers is in a line backwards from head to tail; each feather is modelled with its line running in the same direction, and the effect is that, as the bird flies, the air is thrown off, thrust aside. The scales of fishes are arranged in the same way.

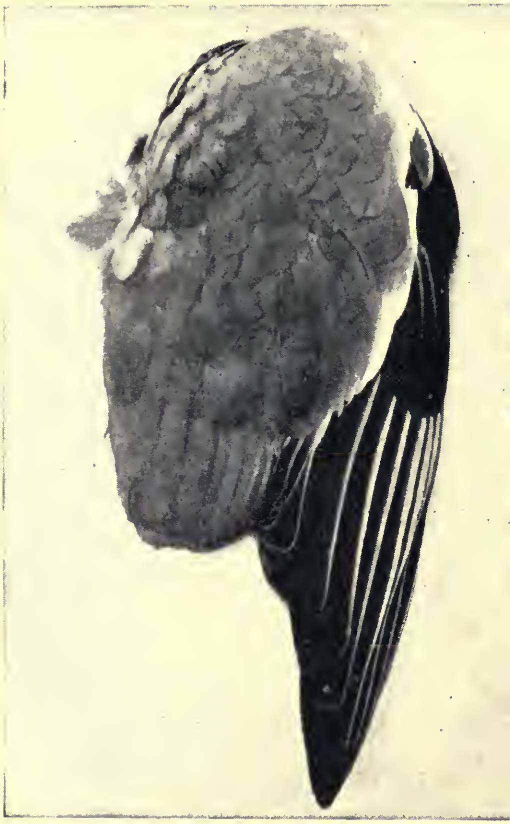
There is another interesting point about the arrangement of feathers. As a bird advances, the feathers act as armour. They will turn aside a missile, unless it be a bullet or anything so deadly as an arrow. If the feathers did not run in a tightly packed line, but were open, and arranged in different ways, the least thing striking them could enter and cause injury. When a bird is struck from behind the effect is different, the shots then penetrating much more readily under the feathers. This fact is so well known that gunners, lurking in wait for wild geese and ducks, let the birds pass by them before firing, and shoot them from behind. The discovery is not new. Mexican warriors knew the advantage of the arrangement of birds' coats of feathery mail, and themselves wore armour of feathers.

Now, how is this feather, which does such wonders for a bird, built up by Nature? There can be no doubt that originally it was a scale, the scale of a reptile from which all birds descend. Birds have reptiles' scales upon their legs, and still preserve relics of the reptile in the composition of their blood and in many parts of their skeletons. The hair of animals has come from the scales of reptiles, and in the rhinoceros has grown into a mighty horn.

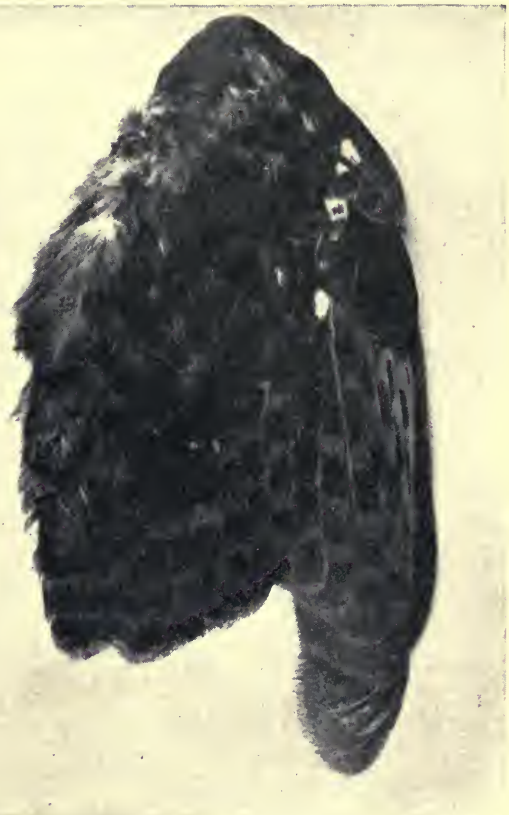
In the feather the scale has become something unique. It is made up of three main parts. First there is the hollow quill, the end of which is inserted in the skin of the bird. This is the part of the feather which for hundreds of years was used, and is still used, for quill pens. Next comes an almost solid part of the feather, which begins where the quill ends. This is the central stem of the feather, from which the web rises, and is called the shaft. The third part is the web, or vane. The quill and shaft are the foundation and scaffolding of the feather; the web is what we may call the wing of the feather. It is made of a great number of very small plates of a horn-like substance, flexible and thin. The quill of the perfect feather is dry, hard, hollow, and empty. When the feather is young and growing, however, the quill is filled with fleshy matter, out of which the entire feather is built up. This food of the feather passes up from the quill into the shaft, which grows in quite a different way from the quill. The shaft is filled with a dry, light, pithy substance. As it grows the shaft bends over its two edges, and these meet below, as we may see for ourselves by examining the grooved under-side of a feather. The complications in the structure

THE BEAUTIFUL PLUMAGE OF THE NECK OF A BUSTARD

THE SWIFT WING AND THE SLOW WING

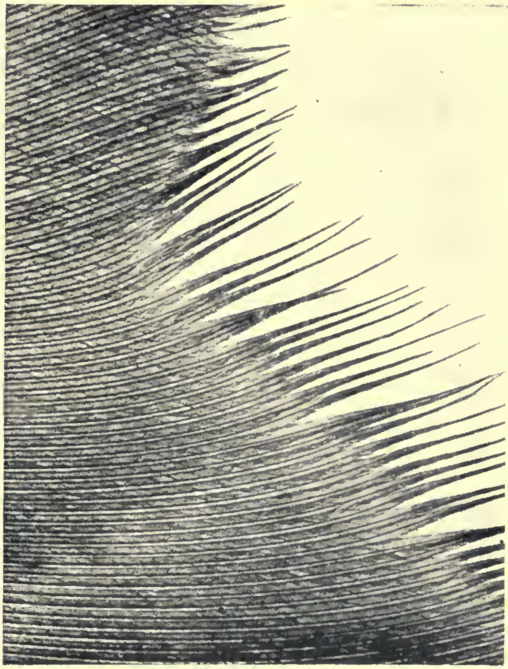


THE SWIFT WING OF A PIGEON



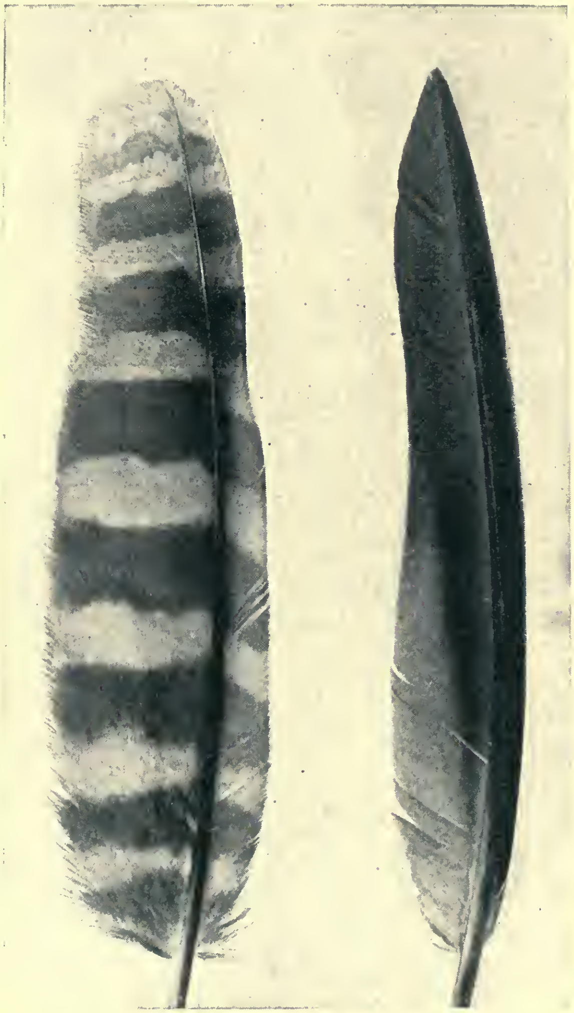
THE SLOW WING OF AN OWL

THE EVEN EDGE OF THE PRIMARY FEATHER FROM THE SWIFT WING OF A PIGEON

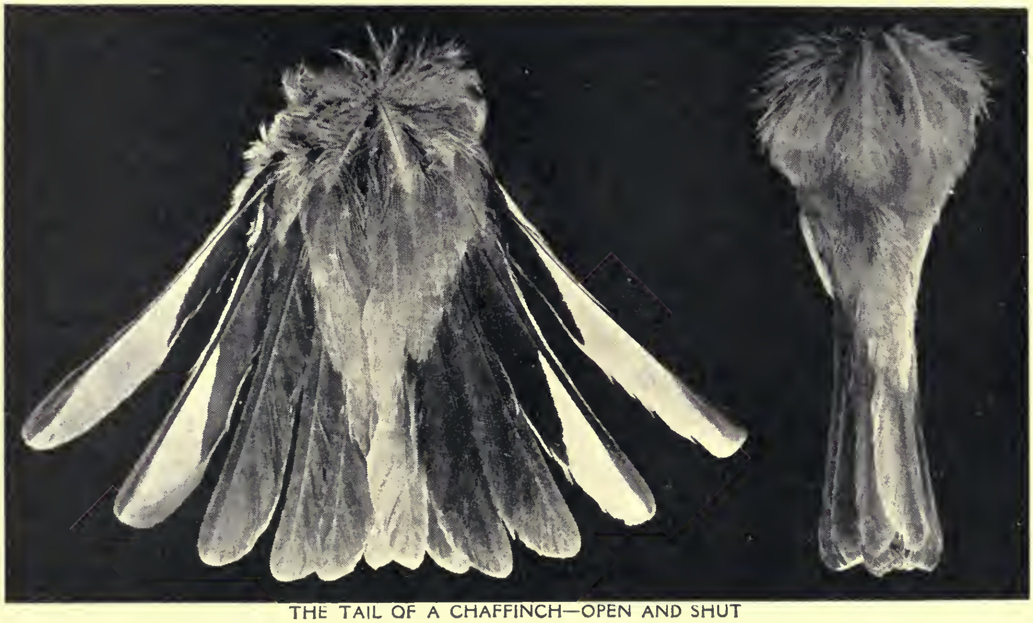


THE JAGGED EDGE OF THE PRIMARY FEATHER FROM THE SLOW WING OF AN OWL arise in the actual vane, or web, of the feather itself.

A perfect feather presents the appearance of being all one piece of perfectly combined material. But the web is in separate parts. From each side of the shaft there springs out a tightly-packed series of the thin, horny plates called barbs. By examining them under a powerful magnifying glass we can see that they are all separate and distinct. How, then, do they hold so beautifully together? Each barb, if examined separately, will be found to resemble a feather in itself, for it gives off lesser branches, as the shaft of the feather itself gives off branches of barbs. But here there are really two rows of branches, the second smaller than the first. These are the parts which bind the web together. The larger branches are made up of a multitude of plates, which constitute the barbs; and from these spring the two lesser branches, which are simply smaller and specialised editions of the barb. They are called barbules and hooklets. They criss-cross, in perfect order, from barb to barb. Each barb sets out from the shaft a separate and independent barb, but the growth of hooked and gripping barbules and hooklets bind all the barbs together, so that the feather may appear what it seems—a perfect whole, light, strong, elastic, pointed at the end, broad on one side of the web, narrow on the other. Every detail is of the utmost importance. Most of the large body feathers of the bird have the after-shaft, or secondary feather. But there is no after-shaft to the flight feathers. The after-shaft grows out of the main feather, where the quill passes into the shaft proper. Such a feather, attached to one of the primaries, would be a serious hindrance to flight, and so none is there. It is interesting to note that in birds, such as the emu, which do not fly the after-shaft is very large, almost, if not quite, equal in size to the full feather itself. It is a typical flight feather that we have been considering, and it is in one of these that we note so many parts. It has been found that along the inner web of a flight feather from the wing of a crane there are about 650 barbs, and each of these carries about 600 pairs of barbules, making 800,000 barbules for the inner web alone, or over a million for the entire feather.


TWO KINDS OF FEATHERS—SOFT AND HARD EDGES
The primary feather of an owl, on the left, and of the wood-pigeon, on the right.

Most of us know that feathers are not rooted all over a bird's body. They rise from well-defined tracts, leaving other tracts of flesh free, but closely covered by feathers growing elsewhere. The reason for this is, of course, that a bird could not fly with its skin full of quills; the skin would be too stiff to give play to the great muscles which it covers. The arrangement of feathers is just as remarkable for the purpose of flight. The wing of a present-day bird consists of what were once its arm and hand. The old-time limb can be clearly traced when the wing is dissected. Now, if we put feathers on our arms and hands, and sought to fly, we should find that the labour of raising the wings before making the downward flight stroke would be more than we could manage for long. The bird's feathers, however, are beautifully arranged. They are planned in such a way that when the wing is being raised the inner side of the web, and of the smaller feathers about them, known as the coverts, are forced down by the air, which can escape through the spaces thus caused, so reducing the pressure upon the wing to the least possible amount. When the up stroke is completed and the down stroke begins, however, the webs are forced upwards, and driven one against another. Thus welded for the instant into a continuous shield, they prevent the air from passing between. The air for the moment becomes to the bird what the water is to a ship. The bird rows itself upon the air ; its wings are its oars, or its propellers.



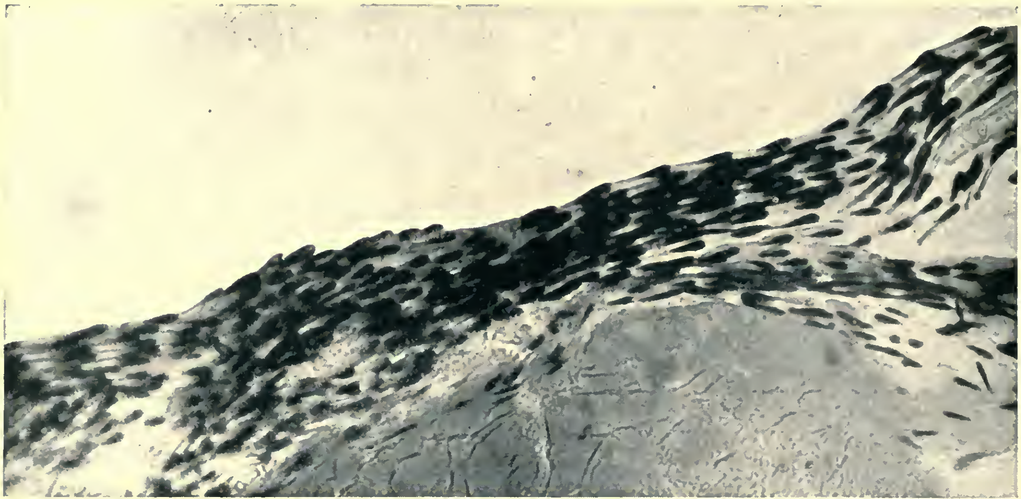
THE TAIL OF A CHAFFINCH—OPEN AND SHUT

Like oars and propellers, the feathers wear out in time, and must be replaced. Some are changed for different reasons. This change of feathers is known as the moult. Animals moult ; horses and dogs and cats shed their hair once a year, as trees shed their leaves. The difference between a bird's feathers and the leaves of a tree is that while the tree may stand bare of leaves for a whole winter, the bird must always be clad in feathers, or it would die. So the moult proceeds gradually, so as not to leave the bird helpless. The rule is that new feathers should come in the place of old in a certain order, and not more than two at a time in the case of the flight feathers. The importance of the rule is shown by an exception. Ducks lose all their old flight feathers at one time, and the consequence is that these magnificent fliers are suddenly left at the mercy of a host of enemies. To help them over this defect the ducks have a new temporary plumage after their moult, dull and inconspicuous, so that the bird may pass unobserved until the big new flight feathers have grown, and enabled it to soar into the air and flee before an enemy. So dull and quiet is this make-shift plumage that it is called the eclipse plumage, a plumage which enables the bird to render itself almost invisible in its native haunts.

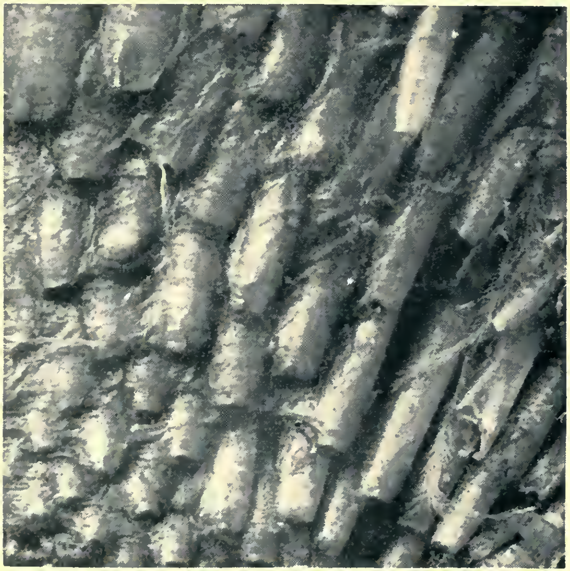
For the most part birds moult once a year, and that is at the end of the nesting period. Handsome birds, which during the nesting season are pictures of flaming colour, take on a dull and sober livery for the winter. When the spring advances, and mating time comes round again, they put on a fresh armour of beauty. In some cases the old, dull colours are shed, and new beauty feathers are grown ; in others it is a part of the feather itself which is shed. The bright colours are there already, concealed beneath dull-toned tips. These tips wear off at the appointed hour, and, lo ! the splendid hues of old are once more before us.

A naturalist will tell us from a few feathers the nature of the bird to which they have belonged. But he cannot tell

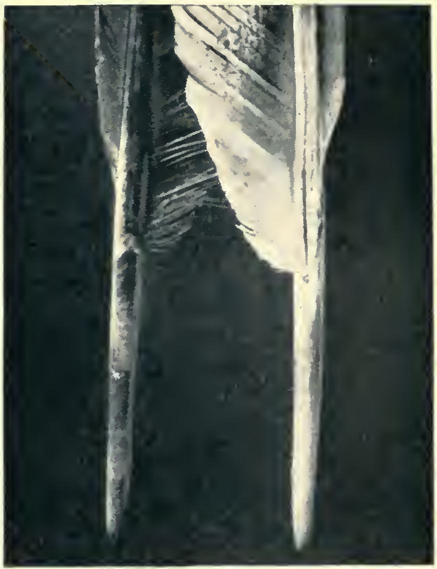
THE STRUCTURE AND GROWTH OF A FEATHER



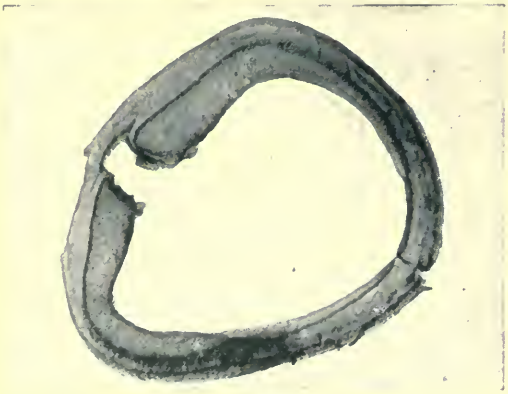
THE YOUNG FEATHERS DEVELOPING ON THE SKIN OF A THRUSH



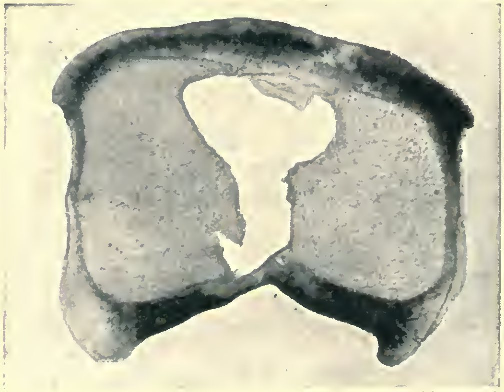
HOW THE QUILLS FIT INTO THE SKIN OF THE GREAT BUSTARD



BOTH SIDES OF A FEATHER, SHOWING THE FORMATION OF THE QUILL AND THE SHAFT

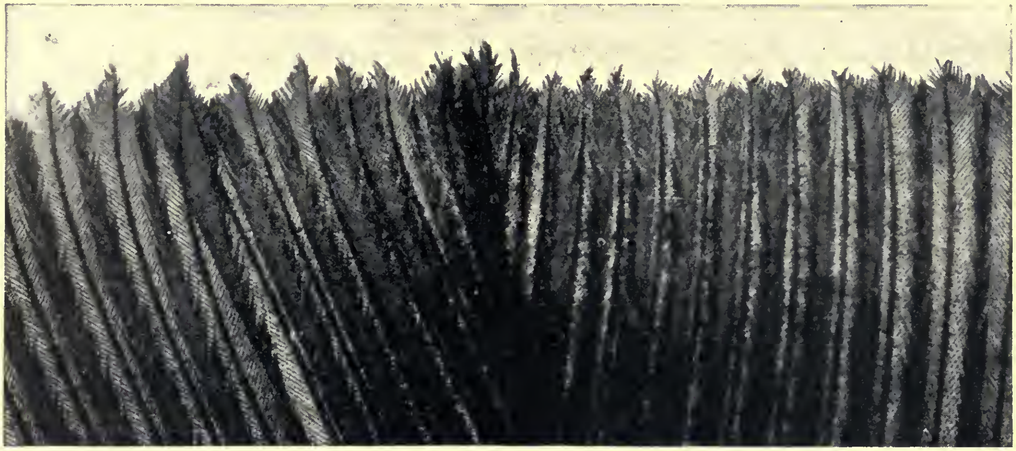


THE BARREL OF A FEATHER FROM A THRUSH'S WING—CUT ACROSS

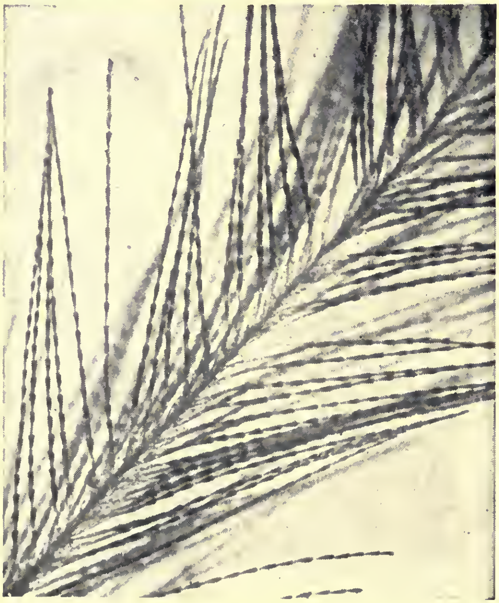


THE SHAFT OF A FEATHER FROM A THRUSH'S WING—CUT ACROSS

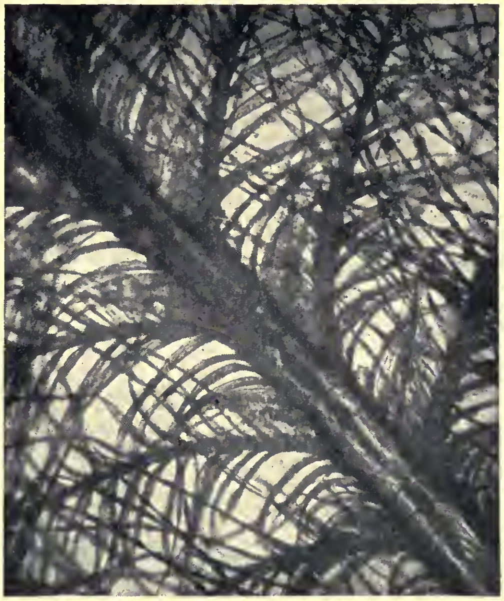
THE TIP OF A FEATHER UNDER THE MICROSCOPE



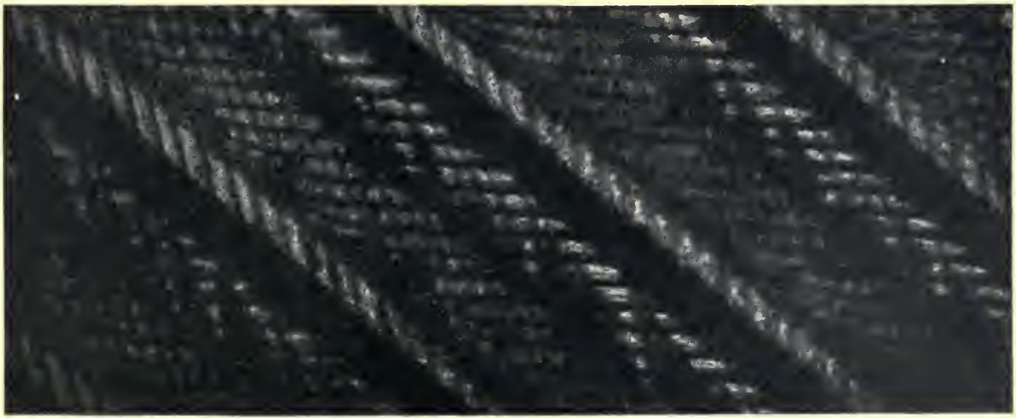
PART OF THE TIP OF A WING FEATHER FROM THE MISSEL-THRUSH—LARGELY MAGNIFIED



A BIT OF DOWN FROM THE BASE OF THE TAIL OF THE HAWFINCH—LARGELY MAGNIFIED

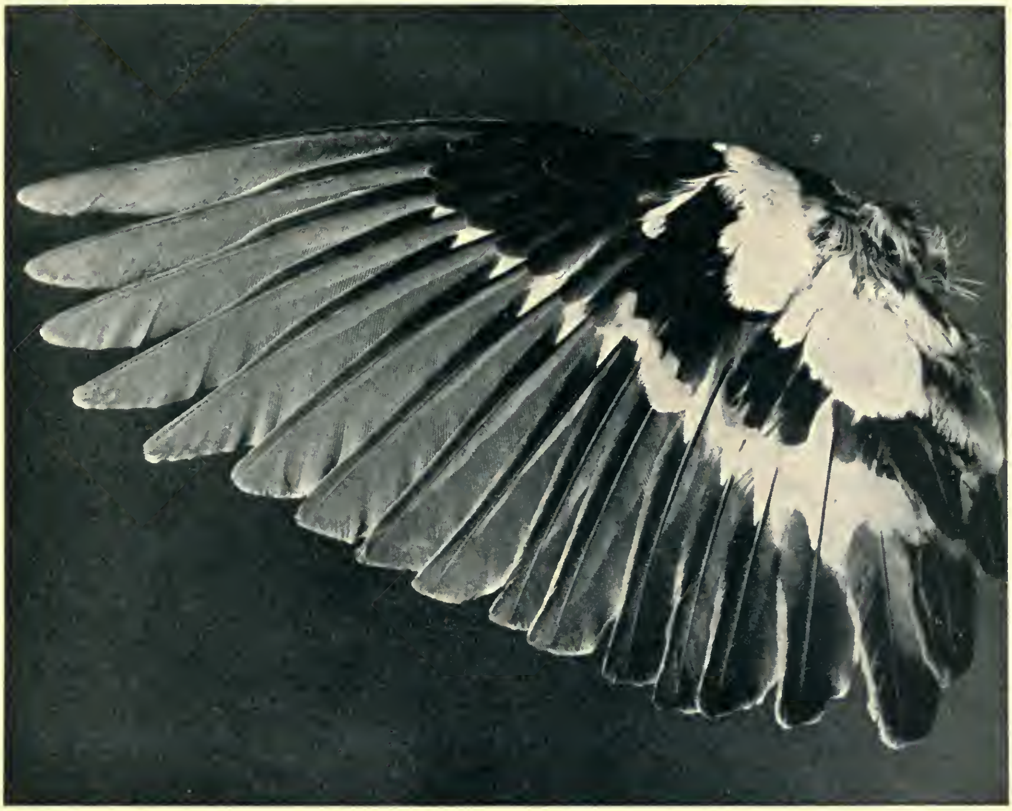


A BIT OF A FEATHER OF A MISSEL-THRUSH, NEAR THE BASE—LARGELY MAGNIFIED

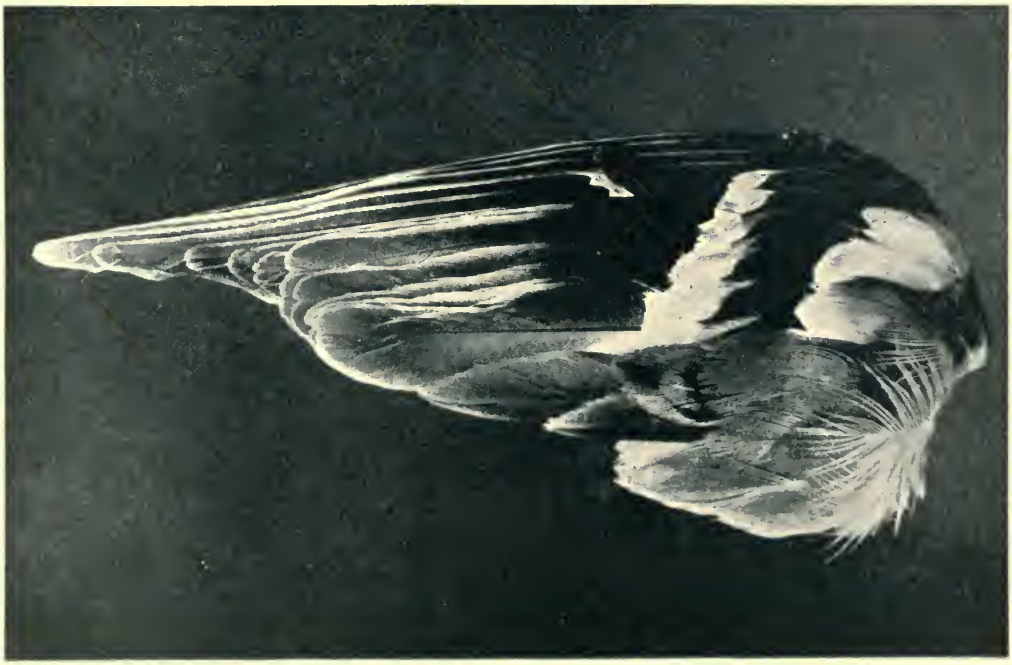


A SMALLER PORTION OF THE TOP PICTURE VERY HIGHLY MAGNIFIED

THE WING OF A FINCH—OPEN AND CLOSED

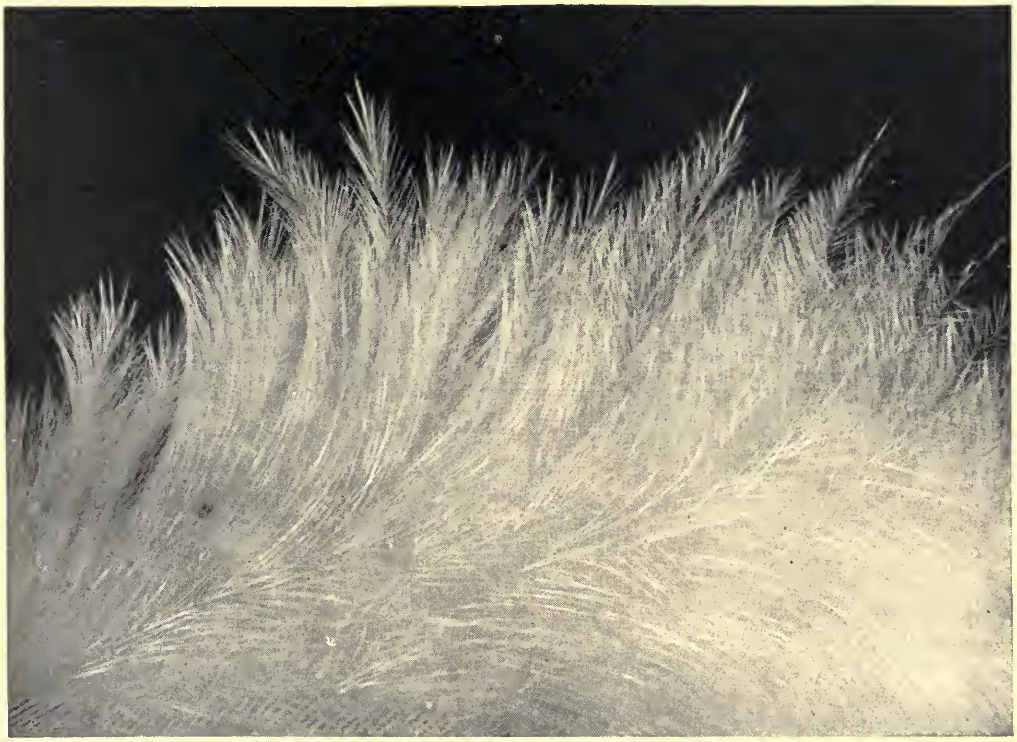


THE WING OF A FINCH IN FULL SPREAD

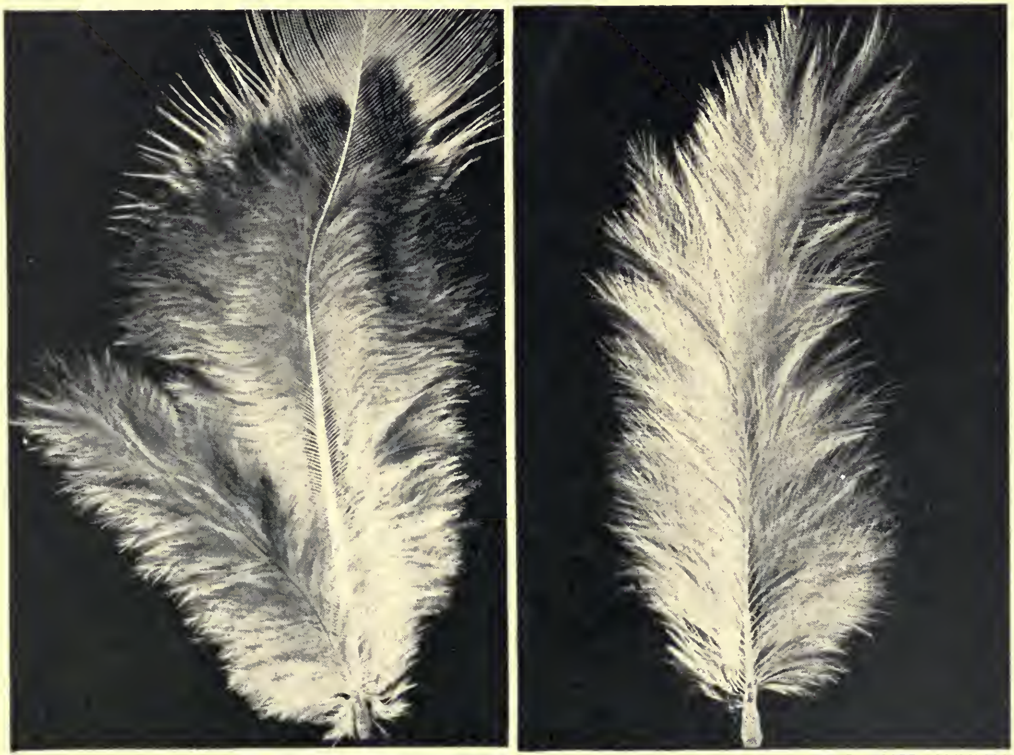


THE WING OF A FINCH TIGHTLY CLOSED

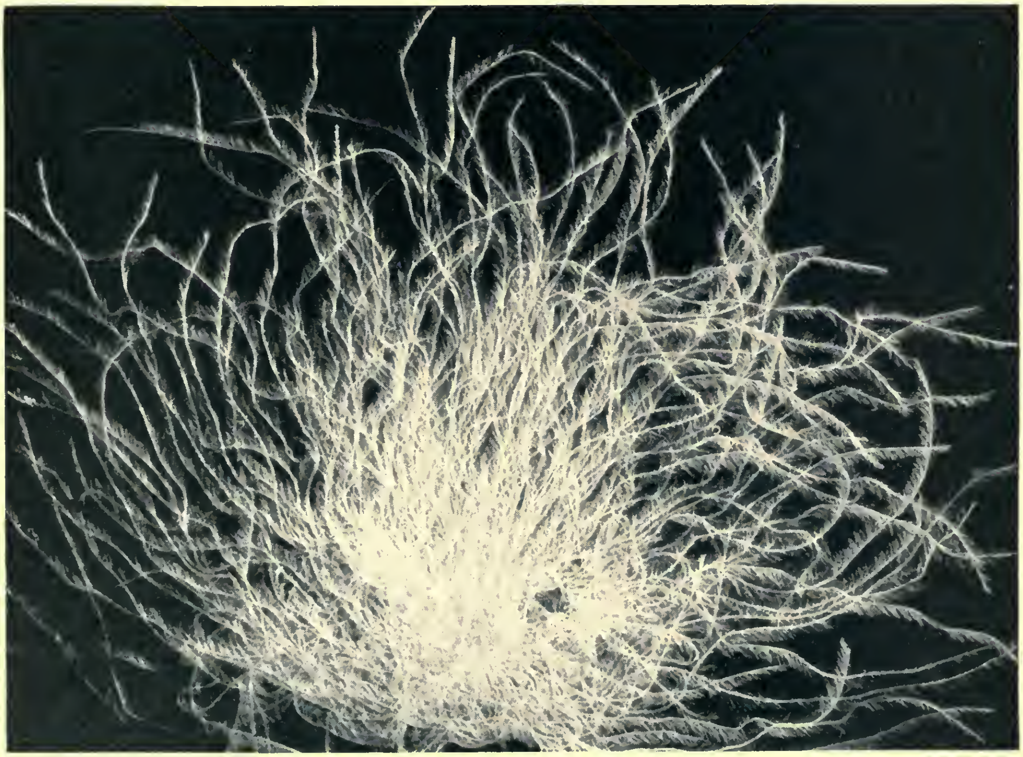
A COMMON WONDER OF THE COUNTRYSIDE



PART OF THE DOWNY PORTION OF THE FEATHER OF A COMMON FOWL



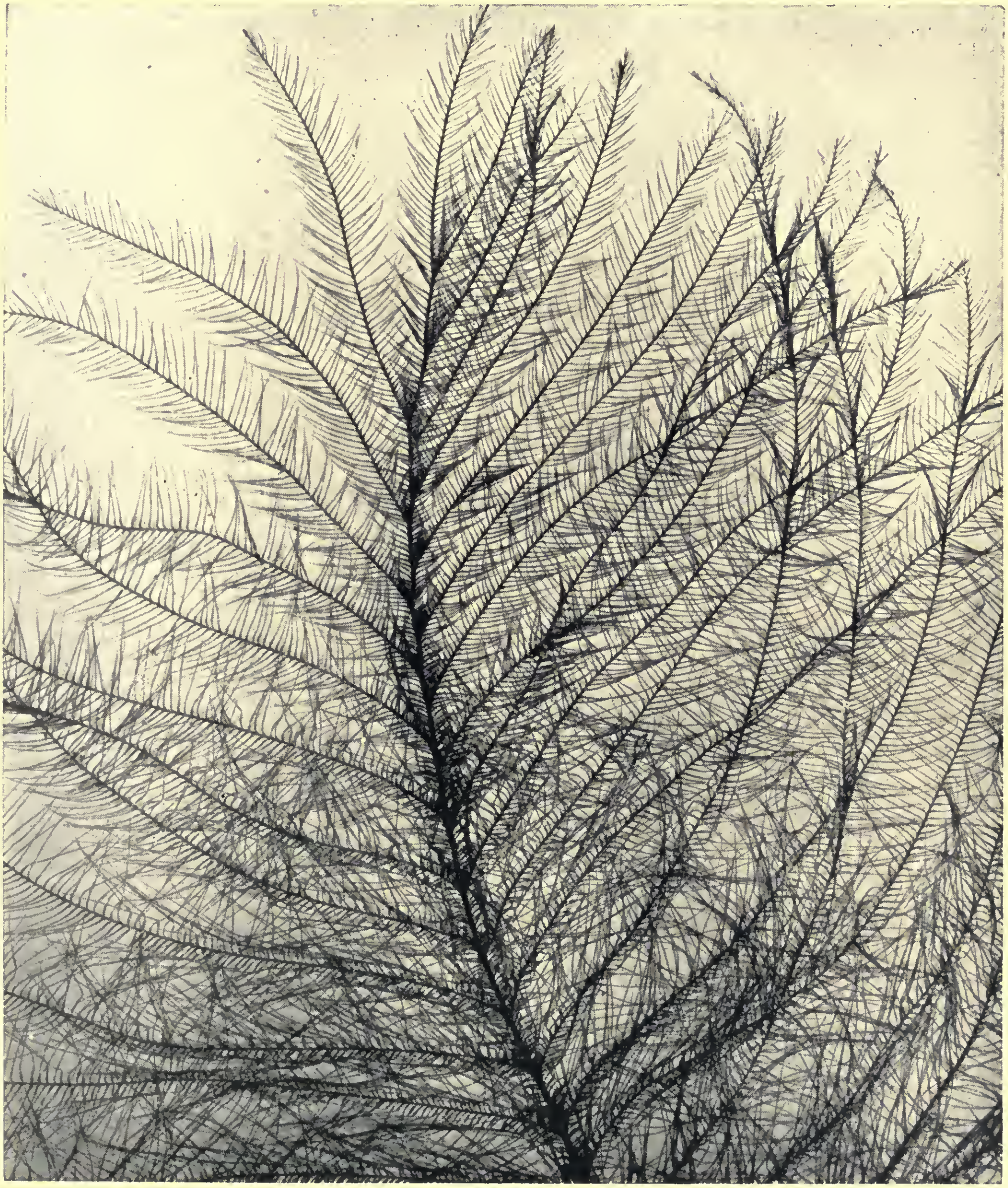
THE FEATHER OF A COMMON FOWL, SHOWING THE AFTER-SHAFT, OR SECONDARY FEATHER—WHICH IS SHOWN BY ITSELF ON THE RIGHT us all the purposes the feathers serve. He cannot explain, for example, the "powder-down" feathers of certain birds of the heron and parrot tribes. These feathers are so brittle at the points that they break up into fine powder as soon as they are formed. We trace this powder on the breast and legs of herons; we find it in the curious coloration which distinguishes the beaks of certain cockatoos and African parrots. Nobody knows the purpose of these remarkable feathers. They must serve some useful end, or they would not exist; but if they are of value to herons and parrots, and to certain hawks, why should not other birds have them?


A BUNCH OF FEATHERS—THE BEAUTIFUL DOWN OF THE EIDER-DUCK

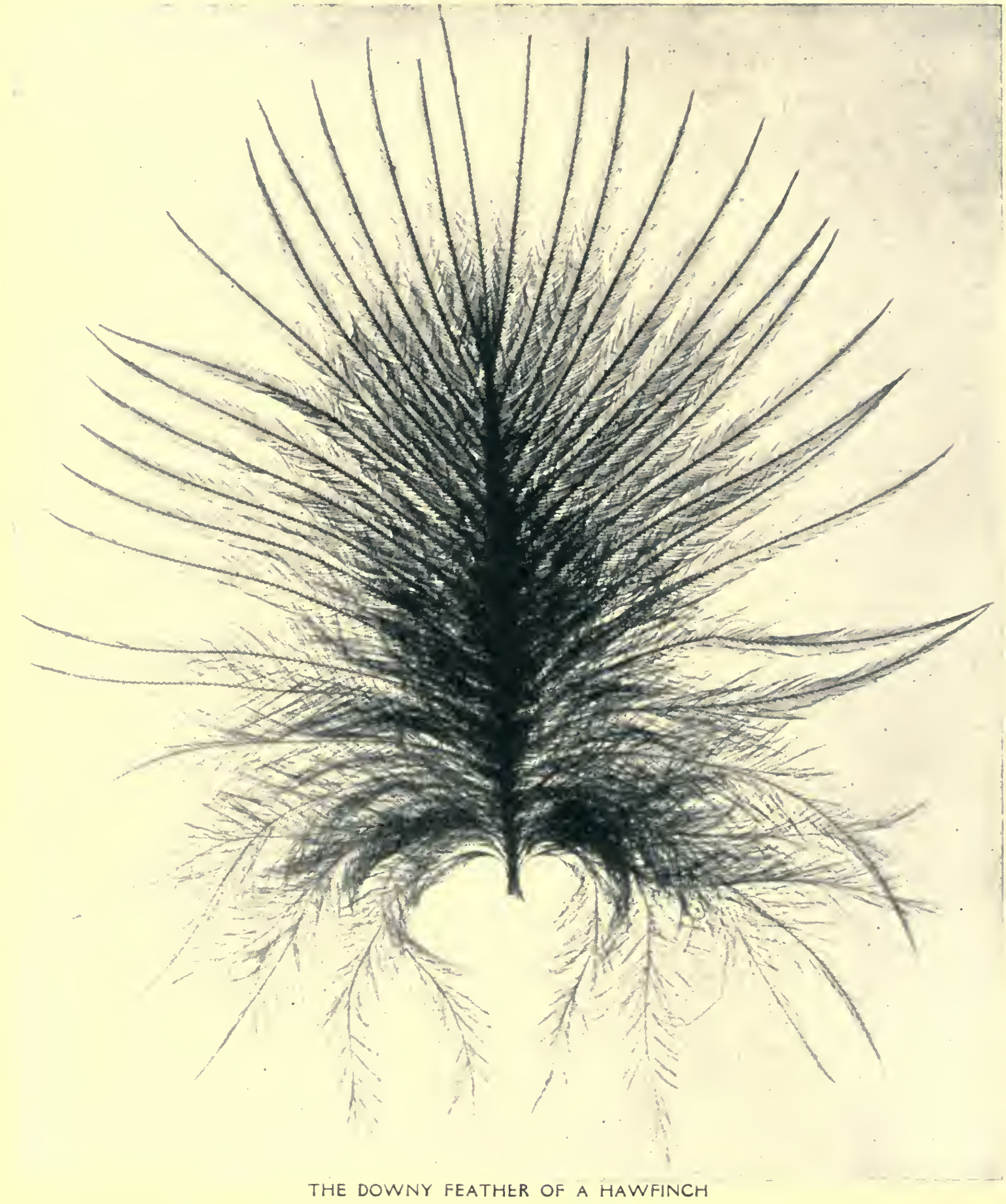
The naturalist, again, will identify the feathers from the wing of an owl, but there are many things about them that he cannot explain. There is something strangely fascinating about this bird. Owls fly, most of them, only late in the evening and through the dark night. They have marvellously clear vision in the dark, and very alert hearing, too. They swoop from a height upon a mouse gently rustling in the grass, upon a rat skulking in the gloom, upon an insect moving where we should need a lantern to find it. Surely the mouse and the rat, so shy and active, should be able to elude so big a bird? So they would if they knew of its presence, but they do not know. The flight of the owl is absolutely noiseless. Nature, when she designed the owl to fly at night, fashioned a form of feather specially fitted for silence. The feathers of an owl's wing are fringed, and softer and more downy than those of a day-flying bird, while its wings have a greater spread than those of most other birds. The result is to give perfect silence of flight.

Not long ago, in an open-air aviary of over a hundred birds, where some young budgerigars were roosting in the warm night on perches fixed to the wires, there was a great uproar. Such a squawking arose as only terrified members of the parrot tribe could make. The writer, suspecting cats, crept between the trees down to the aviary, and as he did so a huge form launched itself into the air and sailed above his head. Its outline was clearly visible against the sky, and was only a few inches overhead. But not a sound could be heard. It was a huge tawny owl, which, flying over the dark garden, had espied the aviary and the young birds camping out. It had been there earlier in the summer, too, for one morning two young budgerigars, which had been roosting on the same perch, were found dead on the ground, with gaping round wounds in their necks. The owl must have clutched them through the wires with his talons.

In another way we see how Nature fits her children for the life they are to lead. The point as to feathers growing only upon certain tracts refers solely to birds that fly. Birds which do not fly have feathers growing from all parts of their body. There is a corresponding distinction in the structure of the feather itself. Ostriches and kindred birds do not fly, so that their feathers are different from those of other birds. Their feathers are not linked tightly together by a million barbules, but are loose and fluffy. The barbules are there, but they do not bind barb to barb. There is no need for a running bird to have feathers adapted to flight. Nature does not waste her gifts. In the same way we find that a bird's feathers generally fit the conditions of its life. The down covering newly hatched birds is scanty upon helpless nestlings, for these have



THE BEAUTIFUL DOWNY FEATHER OF A MISSEL-THRUSH the protection of the parents. But in birds which run about as soon as they are hatched, like chickens, the covering of down is thick and abundant. In the majority of cases the young birds, when they leave the nest to fend for themselves, are very soberly clad, in feathers dull and inconspicuous, like those of their mother. Not until the end of their first year do they put on the handsome garb which, in the case of the males, makes them resemble their fathers. It is desirable that young birds, before they have thoroughly learned the ways of the world, should be screened as much as possible from their enemies, and this sober plumage helps towards this end. Some birds, however, such as the parrots and kingfishers, are brilliantly coloured from the outset. We cannot explain why there should be this difference, but we shall probably learn some day that there was good cause for the departure from the common rule.



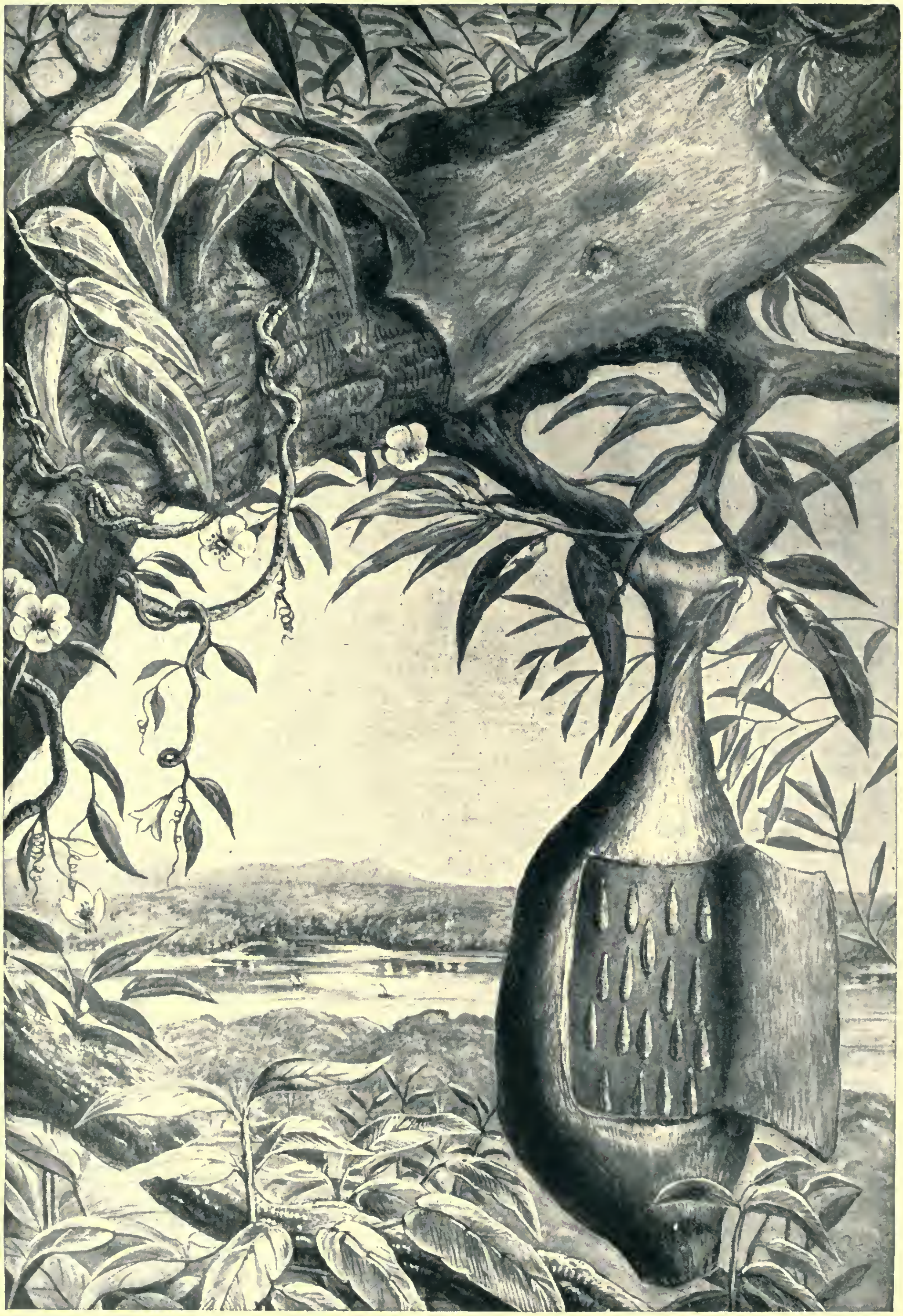
THE DOWNY FEATHER OF A HAWFINCH

Some feathers are plainly intended to be decorative, such as those of the birds of paradise, the metallic splendours of the humming-birds, the gorgeous magnificence of the peacock's tail, the beauty of the tail-feathers worn by the whydah bird during nesting time. These purely decorative effects may be a danger to the bird in the presence of an enemy. The specialised tails of some of the paradise birds, of the peacock and the whydah, are a serious hindrance to flight. Such birds must have reached perfection of plumage in times more peaceful for birds than these. But, whatever the character of the feathers, we find them all wonderful. They clothe the beauty birds with glory; they raise the eagle and the vulture above the highest mountain peaks; they carry the tiny birds over the seas to distant lands, and enable them to find food when faced with famine; they bring them back, with the re-awakening of life, to save us from the ravages of insect pests which would destroy us.

THE CALIFORNIAN CONDOR, WHICH FLIES ABOVE ALL OTHER FORMS OF LIFE

Such is the story of a feather, this masterpiece of Nature's contrivance, this wonder-working instrument; this piece of horn fashioned into a tube, filled with pith, and fringed with myriads of plates. The pride of man is humbled before the simple marvel of a small bird's pinion, fashioned out of the bird's own substance, from material so commonplace—as we wrongly call it—as a worm, a caterpillar, a greenfly, or a pinch of seed.

CATERPILLARS IN THEIR SILKEN CRADLES



THE HANGING NEST, SHOWN OPEN, IN WHICH CATERPILLARS PASS FROM CHRYSALIS TO BUTTERFLY AND, ON THE BOUGH ABOVE A COVERED COLONY OF COCOONS THAT NO ENEMY CAN ENTER

THE LOVE OF A MOTHER

THE WONDERFUL WAY IN WHICH IT RUNS THROUGH ALL CREATION, AND BUILDS UP LIFE FROM AGE TO AGE

HOW THE INSECTS GUARD THEIR LITTLE ONES

THE noblest thing in all the world is your mother's love for you, and this beautiful thing, without which the world could not have been, runs through creation. The great love which moves a mother to live or die, if need be, for her children, has its root deep in the universe, and from this seed springs the happiness of our race and the future of all life.

It is really true, as Charles Dickens said, that it is love that makes the world go round. Throughout the animal world, as in the human race, runs this golden thread of love. Even the fierce spider, which gobbles up her husband, is a loving mother to her children ; the savage crocodile valiantly defends the eggs she has laid ; the cold-blooded serpent, which will kill every other living thing, coils her form around the eggs from which her children will emerge. The mother bear is never so much to be feared as when her cubs need defending ; the mother elephant is never so skilful and clever as when her baby gambols clumsily at her side.

Yet crocodile and bear and elephant, admirable as they are in motherhood, are not more admirable than the humble earwig, not so laborious in their nursery duties as the bee and the ant and the wasp. Such insects, indeed, rank next to mankind as wise and loving parents. All that they do in planning and organising their lives is prompted by the love of their little ones. The homes they make, marvels of accurate design and finish, are not for themselves, but for their helpless young. That is a great thing to remember—that every ant city, every beehive, exists, not for the protection of the living insects, but for the protection of the coming generation.

We remember that many kinds of insects never see their children, and we ask ourselves, Can it be love for their unknown little ones which prompts these insects to labour in constructing nurseries and laying up stores of food? Nobody can answer that with certainty. Man is very wise, but he does not know all things. The senses of insects are not like our own, and we do not know how insects feel towards one another, whether love guides them, or what we call instinct. What is instinct? It is described by one of our highest authorities as "reasoning which is organised, systematised, automatic." Let us bear that in mind, for it helps us to understand the puzzling question which rises to the mind, Can insects be said to love their children whom they never see? Some children's questions perplex the most learned philosophers, and this is one of them. Let us follow it up for a moment.

We know that millions of moths, butterflies, midges, and other winged insects die soon after leaving the chrysalis stage. These can never see their little ones, yet, in due season, in place of the parents the children appear. Many moths and butterflies do not eat, cannot eat. Their mouths are imperfect. The insects have a food reserve in their bodies on leaving the chrysalis, and when that is exhausted they die. How does a butterfly, which does not eat, understand the kind of food its caterpillar will require? How can the midge, whose life as a perfect insect is passed on the wing, know that its eggs must be laid in water? How does the lordly dragon-fly know the same thing? Is it love for the children who will not be born until they themselves are dead which guides them, and prompts this marvellous selection of place for the eggs? The answer to this has taken a long time to discover, and it is a fascinating one.

It is believed that long, long ago the insects which now die as soon as they have laid their eggs lived much longer. The butterfly of today, which cannot eat, had ancestors that could eat, and did eat, and may have lived long, and in that age insects would learn to choose the right food for their little ones. They would see the eggs hatch, and the little ones grow up and thrive when their food and their surroundings were favourable. Gradually they would learn by experience the place to choose and the kind of food to select. Those insects, profiting by experience, would leave large families behind, and these would learn to deposit their eggs in the right place. Those not profiting by experience would see their little ones perish, and would die without leaving families behind. In course of time, as the right and wise choice grew into a habit, the care of the parents for their young would become less and less necessary.

THE MOTHERS WHO LIVE JUST LONG ENOUGH TO LAY THEIR EGGS AND DIE

The process of laying eggs would be hurried on ; the insect would live its life at a greater rate, as we say ; and, a great amount of work being crowded into shorter space, the little body of the fragile insect would wear out sooner. So the lives of the parents grew shorter and shorter, until today many insect mothers have nothing to do but lay their eggs and die. Let us take one—the clothes moth. She never eats, because she cannot, yet there is not a living creature in the world that takes greater care in selecting a nursery for her young. She chooses a garment of wool or hair, and from her eggs come forth the tiniest of caterpillars. The garment chosen by the careful little mother is the luxuriant pasture of the baby caterpillar, which eats the fabric upon which it is hatched with as great a delight as a beautiful fawn eats the sweet grass of the park.

Perhaps in this we have the key to our riddle, for it would seem as if the mother moth, though she no longer sees her children, inherits an instinct of love from the ages when her ancestors lived longer and did see their little ones. The wonder is not less, however, but rather more, when we seem to understand it better ; and it must remain one of the greatest marvels of Nature that an insect mother should love and protect the little one unborn, whom she can never see or know, except by a faith which is almost incredible and miraculous.

THE WONDERFUL CITY OF THE BEE AND THE LAWS THAT GOVERN IT

If we could trace the whole mystery of the way in which insects have learnt to protect their young, what a marvellous chapter of natural history we should have ! We should learn how the bees and the ants came to form their matchless cities and create an organisation ranking next to that of man himself. Ages and ages must have gone to the creation of the bee system—a system of building, manufacture, organisation of labour, feeding of the young, the cleaning and ventilating of the hive. Everything done in the hive is for the little ones and their mother. There is a law in every hive that the queen shall lay the eggs from which all the children of the hive are born, while all the others are workers or drones. The drones are sent out of the hive when they grow up, never to return ; the others are simply workers. They build ; they sweep and garnish ; they collect and store food ; they work in gangs, fanning their wings to keep the hive cool so that the little ones, hatched from their eggs in the cells, shall not suffer from heat ; they wait upon the queen, feed her, brush and tidy her, and perform all the duties that the veriest slave would do. For the queen bee is their mother, the mother of the teeming swarms of little ones for whose protection they live and labour.

The case is the same in the city of the ants. There the queen is the mother of all the occupants, and the wingless workers devote their lives to their children. Some of these will become queens.

THE SLAVE BEES, THE MOST INDUSTRIOUS LITTLE CREATURES ON THE EARTH

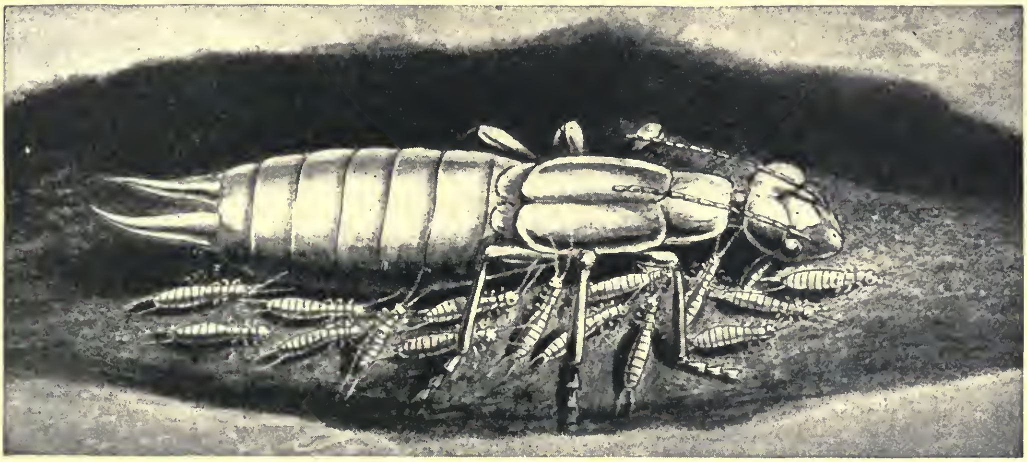
All the strange and mysterious complications of the ant city are created simply that the children of the queen may thrive and grow up, some to fly forth as queens and establish cities of their own, and some as drones, which at the right time are sent forth from the city to return to it no more. The rest are workers, willing slaves, the most industrious little creatures on earth. The queen bee and the queen ant are at the pinnacle of insect organisation, but there are equal wonders to be found among bees and wasps which do not assemble in cities.

Here each mother has to make a little dwelling of her own, and it is strange to trace the different plans followed. Some of the wasps—our common wasps, for example—are social in their habits. They do not dwell in hives in the midst of a population which goes on from year to year, but create a family round themselves during the summer, and for a few months have a properly organised city, such as the first of the old-world beehives must have been. There comes a time in every year when all the worker wasps die ; only the queens live through the winter. In the spring the queen seeks a site for her nest. It may be a hole in the ground, or a hollow tree, it may even be a position beneath the roof of a house. She chews woody, fibrous substances into a

LITTLE MOTHERS AND THEIR FAMILIES

A MOTHER SPIDER CARRYING HER YOUNG LEST HARM SHOULD COME TO THEM IN HER ABSENCE

A MOTHER MOLE CRICKET WITH HER FAMILY



AN EARWIG GUARDING HER LITTLE ONES

paste, which hardens into a sort of paper, and of this her cells are made. In each of these she lays an egg, from which a worker wasp appears in a very short time. Each worker at once begins to build new cells, and to help its mother with the labour of the home. The nest grows bigger and bigger, tier upon tier. In each cell the queen wasp places an egg. More workers are born, and when all is ready the new queen wasps and the drones are hatched. These fly forth and do not return. The labour of the home is completed. The workers have done their task. They have seen the queens and the princes depart, and they are ready for death.

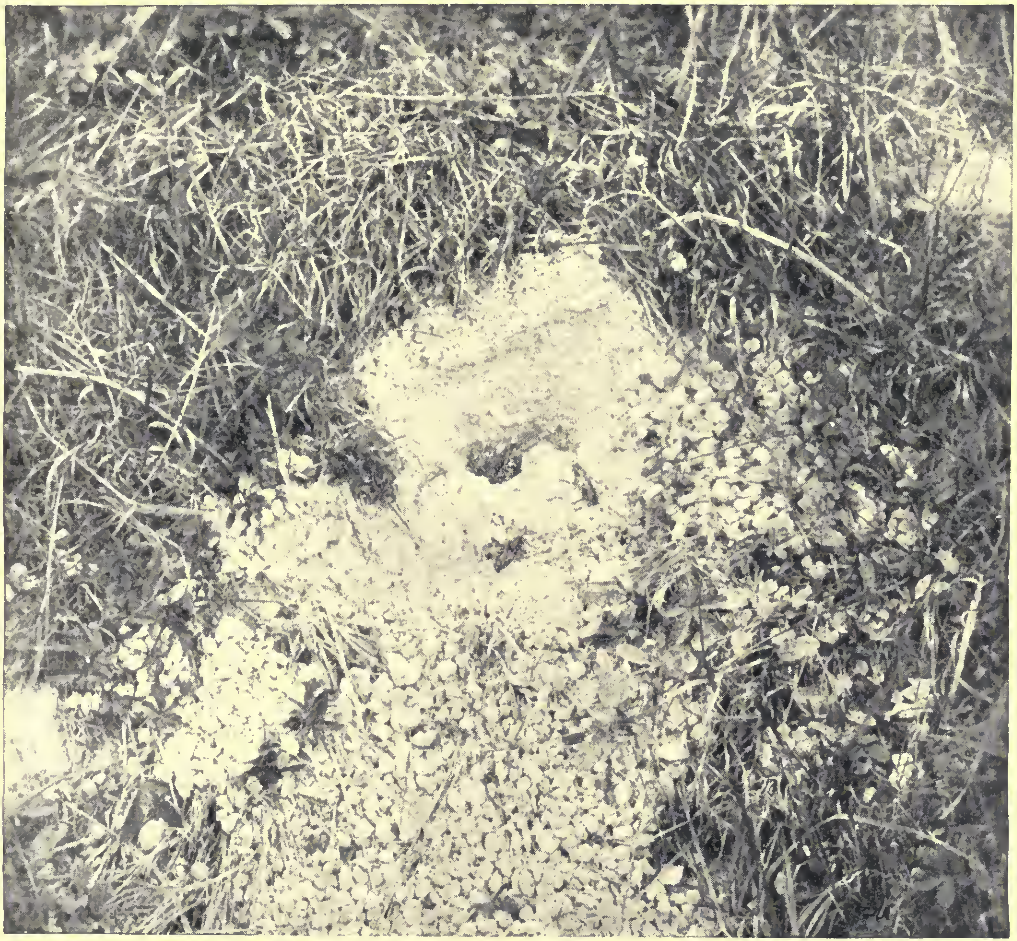
Many kinds of homes are made by wasps and bees whose organisation runs upon these lines Some of the wasps hang splendid nests from the boughs of bushes and trees. The queen begins the work ; the workers help her to finish it. The best example of this kind is that of the wood wasps, of which there are many species. One foreign wood wasp has so many children that the united labours of all produce a nest five feet in length. What an enormous structure to be made by such little insects!

Another interesting nest is that of what we call the solitary wasps. Here the mother wasp has the entire responsibility of providing for her family, and she makes the nursery in all sorts of places. It may be a little home tunnelled in a sandbank, or in a mud wall, or in timber ; sometimes advantage may be taken of an inviting keyhole. The house may be fashioned of paper made from wood or fibre, or of mud, or even of little pellets of sand cemented together by a fluid from the mouth of the insect. An example that we may all study is the common mud-wasp.

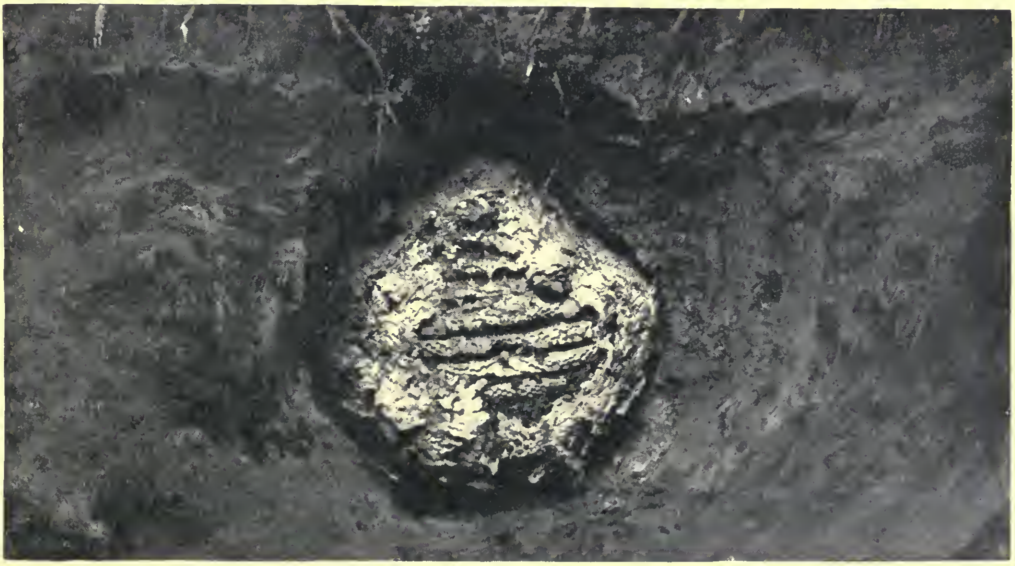
She collects wet mud, and forms a thick-walled, thimble-like room or cell, and lines it with paper, forming the snuggest little dwelling imaginable. Here she lays her egg. The mother will not be there when the larva leaves the egg ; she will never see the little creature for which she is making a home, so she must prepare a food supply to last it through its infant life. Bees can make honey, wasps cannot, so the wasp must provide an artificial food supply. This is done in an extraordinary way. The mother wasp attacks another insect ; it may be caterpillar, spider, or moth. Now, if the insect were simply walled up in the nest until such time as the wasp grub hatched and could eat, the prisoner would

A DOR BEETLE TEARING UP FOOD, AND THE MOTHER WORKING IT INTO A BALL FOR HER YOUNG

THE SNUG HOME OF A WASP FAMILY IN A BANK

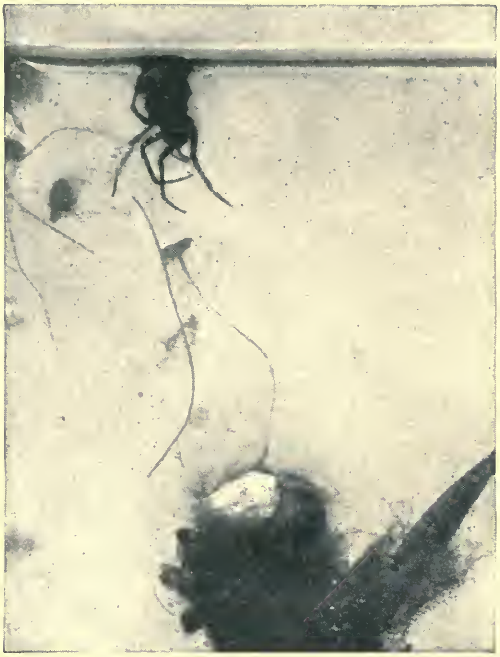


THE ENTRANCE TO A WASPS' NEST IN A BANK

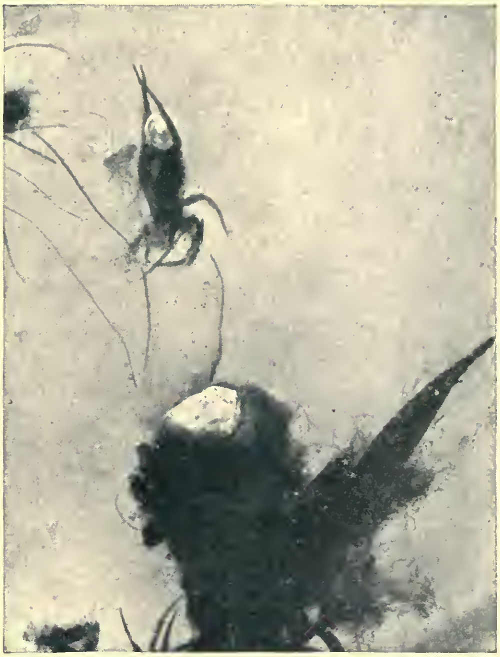


THE INSIDE OF A WASPS' NEST DUG OUT OF A GARDEN BANK

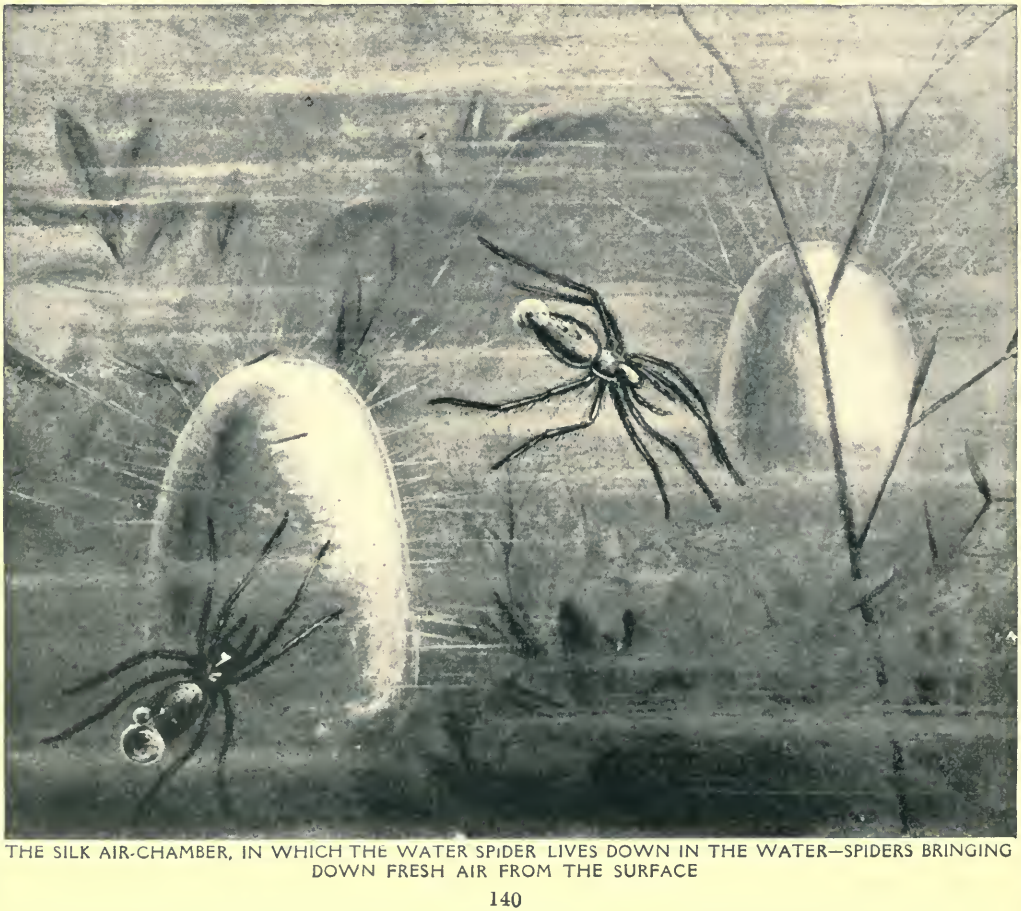
THE MARVELLOUS HOMES OF THE WATER SPIDER



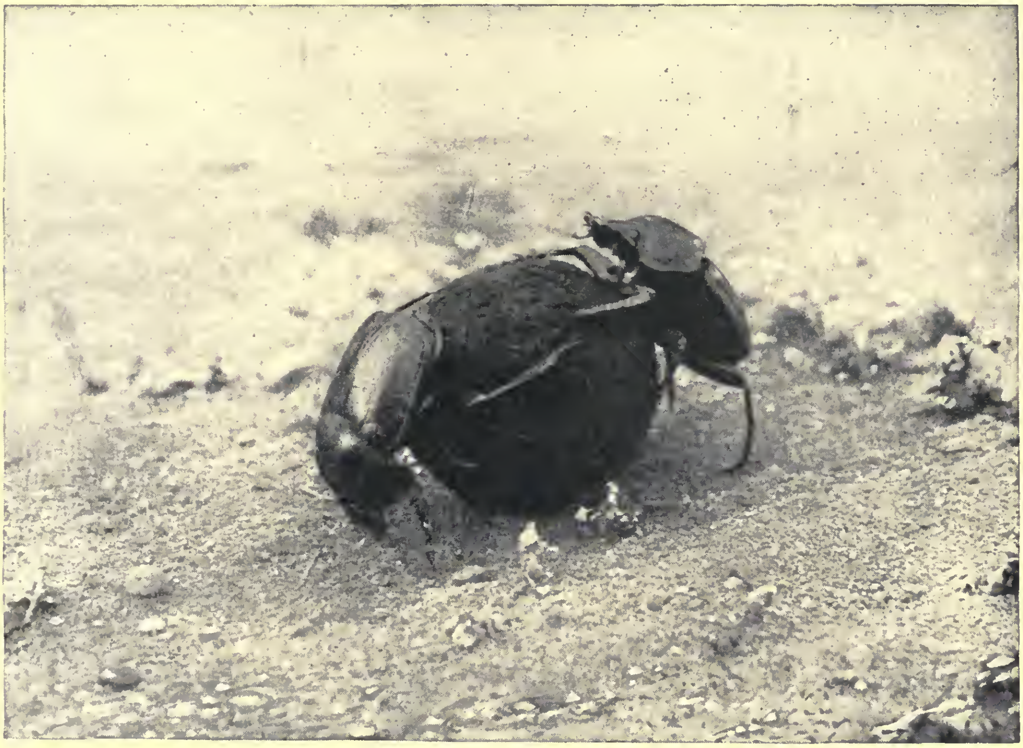
THE WATER SPIDER COMES UP FOR AN AIR BUBBLE



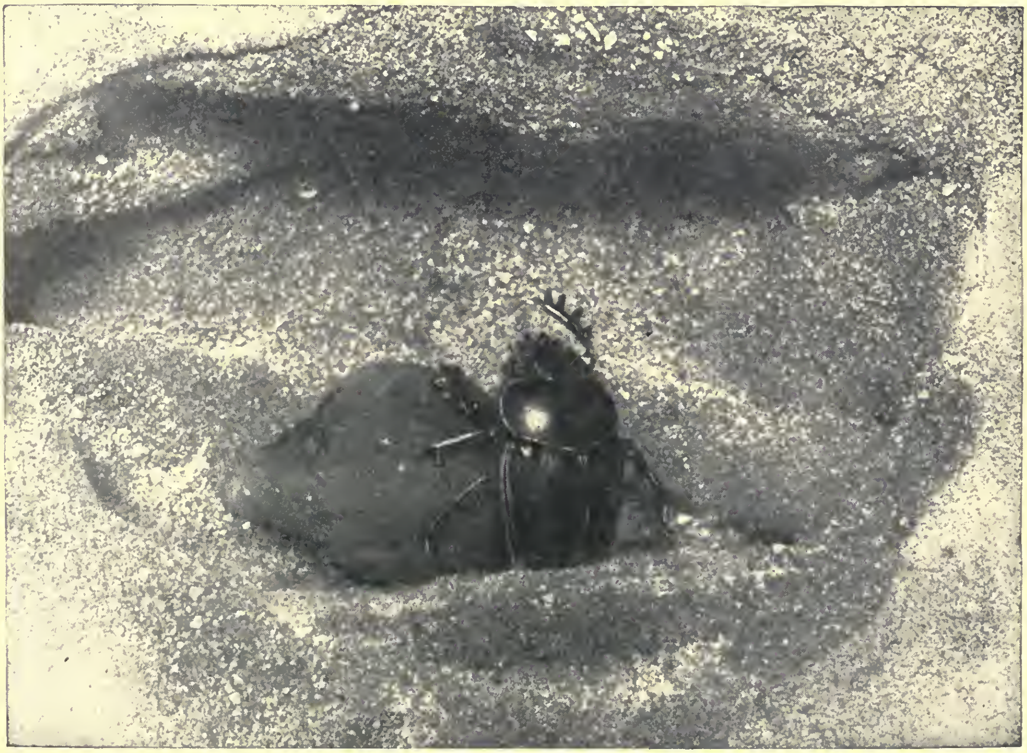
AND CARRIES THE BUBBLE TO ITS NEST



THE SILK AIR-CHAMBER, IN WHICH THE WATER SPIDER LIVES DOWN IN THE WATER—SPIDERS BRINGING DOWN FRESH AIR FROM THE SURFACE



SACRED SCARAB BEETLES PUSHING HOME A BALL OF FOOD



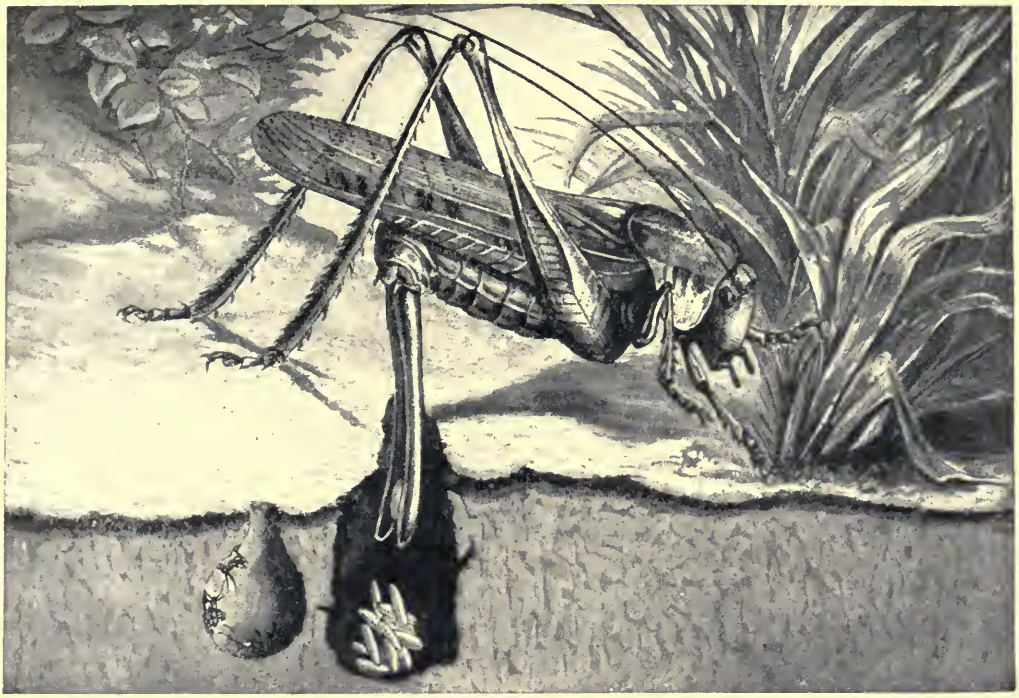
THE SCARAB BEETLE PREPARING THE FOOD AND THE NEST FOR HER EGGS die and become poisonous. To prevent that, the wasp stings it in a vital place. The wound paralyses the insect so that it cannot move, and cannot feel any pain. Paralysed and insensible, the insect will retain just enough life to last until the young grub emerges from the egg of the mother wasp, and its body will be there ready to form a meal for the little creature emerging into life. The cells stocked by a solitary wasp may contain a number of such victims, each cell possessing a supply of food sufficient to last the infant until it passes from the larva stage into a complete wasp. The idea of leaving a wounded insect alive and lingering in this way seems horrible to us, but there is consolation in the thought that the victim instantly loses all sense of pain, and knows nothing of what happens. Insects using sting and poison are unerring in their aim. They know exactly where to strike, and, as it is a great nerve-centre which is maimed, there can be no feeling or sensation afterwards.

The solitary bees have prettier ways than this. They leave honey for their babies, and leave it in models of skilful contrivance. When we see holes in the rose leaves—clean-cut, semicircular holes — we know that one of the leaf-cutting bees has been there for a cradle. Very cleverly she makes a tunnel in the ground or in the trunk of a tree or in a wooden post; then she flies to a rose leaf or a willow leaf, hangs by her legs to the edge of it, and with her strong jaws cuts away a piece the exact size required. As she hangs to the part she is cutting, unless she were careful she would be like the Irishman in the story who, climbing the bell-rope to steal it, cut the rope above his head, and fell with it. But our bee is too wise for that. Just before she makes the last cut she sets her wings in motion, and hovers steadily in the air. Then she flies to her tunnel, shapes the piece of leaf like a thimble, and lines the bottom of the boring with it. When it is made quite secure, she flies off to the flower-bed, collects nectar and pollen, kneads a little loaf of "bee-bread," deposits it in the leaf, and lays an egg in the larder-cradle.

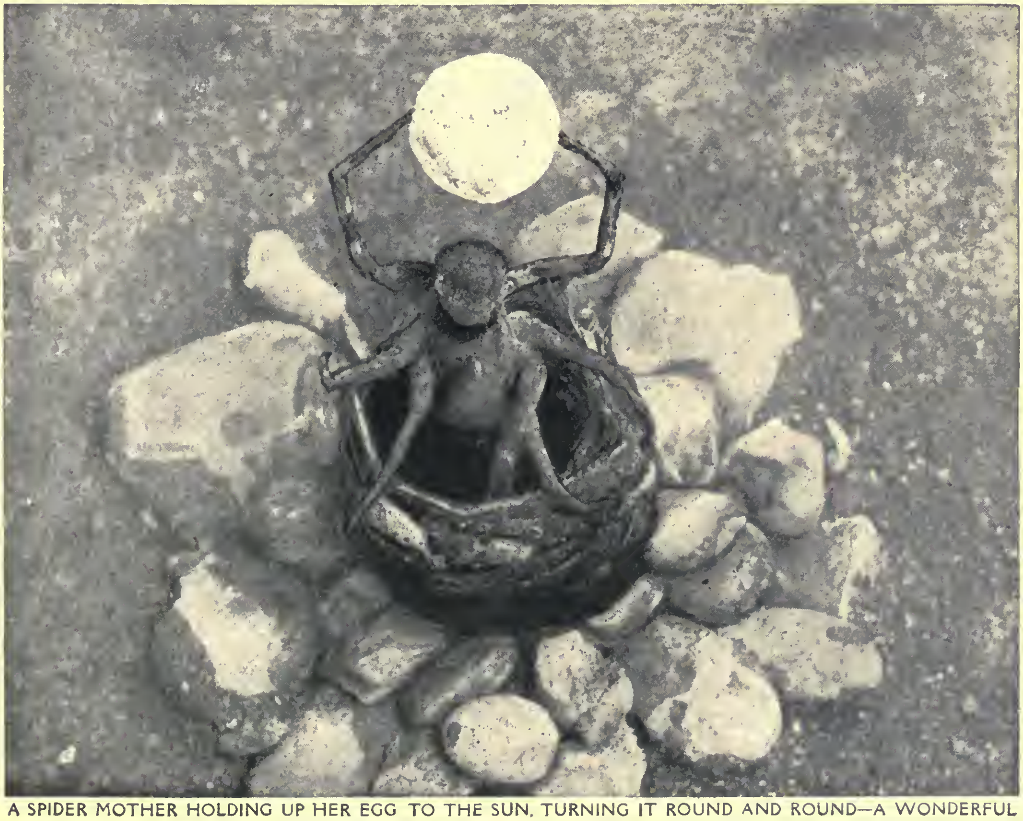
EGGS OF THE COMMON AND STONE HUMBLE BEES IN THEIR UNDERGROUND NESTS

THE MUD NEST OF A TROPICAL WASP, SHOWING THE COMB IN WHICH IT LAYS ITS EGGS

THE CARPENTER BEE'S HOUSE OF MANY STOREYS IN THE BRANCH OF A TREE



A GRASSHOPPER DEPOSITING HER EGGS IN A NEST UNDER THE GROUND



A SPIDER MOTHER HOLDING UP HER EGG TO THE SUN, TURNING IT ROUND AND ROUND—A WONDERFUL PHOTOGRAPH TAKEN BY A FRENCH NATURALIST

Next she cuts another piece of leaf, and with this roofs over the cell. Afterwards she cuts still more leaf, and with that makes a second cell, which she rests on top of the first, the bottom, shaped like the nose of a thimble, fitting perfectly into the hollowed roof of the one below. With great care she seals up all the places from which honey might leak, and to this cell also she gives an egg and a supply of pollen and honey. From six to ten cells, one on top of another, may be made in this way, until the shaft is filled with cradles. The top of the tunnel is then covered over, and the bee flies away, knowing, we may imagine, that she has done her duty to the children that are to come to life in this marvellous home she has made.

THE WONDERFUL HOUSE THAT THE CARPENTER BEE BUILDS

Carpenter bees make still more elaborate homes. They bore deep tunnels inside the trunks of trees. At the lowest depth a little chamber is prepared. Here the bee deposits an egg with a proper food supply. Then the chamber is tightly roofed over with watertight paper made by the bee from the wood of the tree. Above this first chamber a second is made, and this in turn is stored with an egg and food before the roof is put on. The roof of the cell below serves for the floor of the chamber above. It is a beautiful piece of work, about as thick as a penny, and made in rings, the outer ring being cemented to the wood of the tree, the inner rings gradually filling up the opening until the cell is completely closed. The chewed wood of which the ceiling is formed is rendered watertight by a fluid from the bee's mouth, so that there is no danger of the honey stored in one cell leaking into the one below and leaving the little tenant to starve. A carpenter bee may make two or three such tunnels, each with from seven to eight cells, so that we may imagine with what great determination she works for the good of the children she will never see.

THE TINY HOUSES WE MAY FIND IN THE BRANCH OF A TREE

Not all the boring bees go to such great trouble; some of them make charming little cradles for their young in the pith of such plants as the hemlock; others tunnel into the rose-bush and the blackberry. If we examine branches of trees that have been cut, we may find a little opening at the end, and in such a branch we are almost sure to find one of these masterpieces of insect architecture.

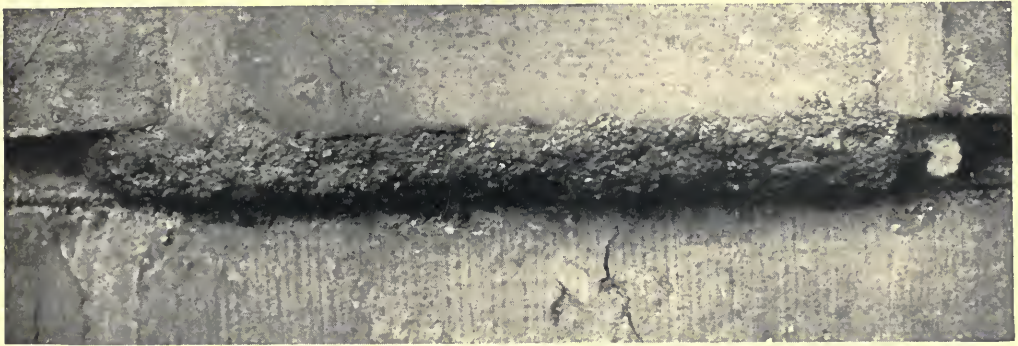
We should keep our eyes open, too, for snail-shells which seem to be empty, for the solitary bee makes its cradle in these. Entering the shell, the mother lays down a stock of pollen-bread, and places her egg upon it. She then builds a roof over it, and forms a second shell in the same way. The shell, if a large one, may be divided into partitions, so that cell lies by cell. As if to show that homes need not all be made on the same pattern, one clever bee, finding the shell too wide at the mouth to support upright cells, made two side by side, but laid them horizontally, and that shell is now at the British Museum. The home of the little solitary bee and the sculptures of the Kings of Egypt are equally honoured exhibits in that home of wonders.

The leaf-cutting bee is not the only insect to employ leaves for the cradles of its young ones. Leaves form the homes of many of Nature's tiny children; some tiny moths pass their caterpillar stage actually within leaves, tunnelling the leaves and eating the parts they excavate, just as the great fat larvæ of the wood-boring beetles eat the pulped fragments of wood that they gnaw in the interior of tree-trunks.

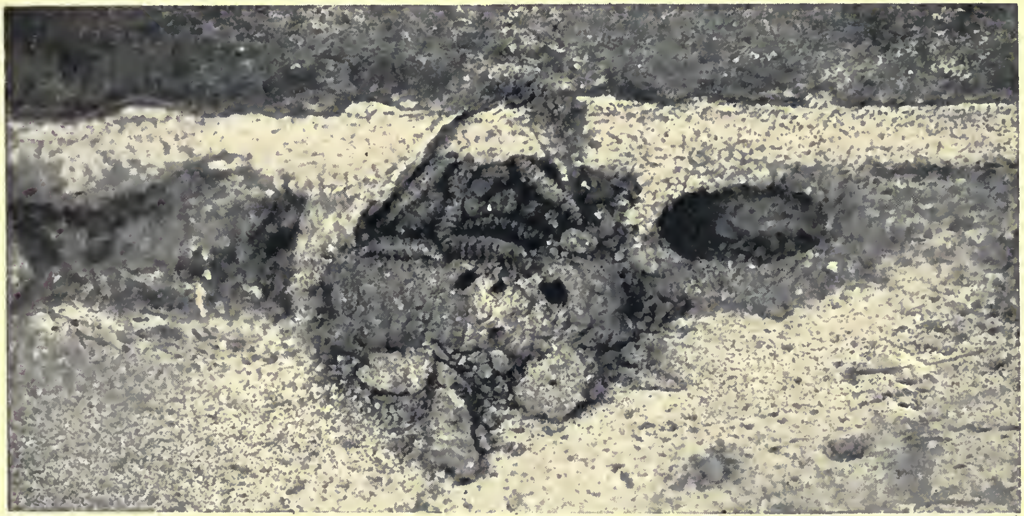
THE CLEVER CRADLE MADE BY A MOTHER BEETLE FROM A LEAF

But we come now to work upon leaves performed not by the larvæ but by their parents—the leaf-rolling beetles. These beetles make cuts in the leaves as the bees do, but for a different purpose. Beginning at the top of a leaf, they bite a semicircular track down to the tough centre of the leaf, which we call the midrib. Half the leaf, detached from its upper support, hangs limp, and this half is rolled down by the beetle into a series of coils, which hang parallel to the midrib. Then the second half of the leaf is cut in the same way as the first, but is wound round the first half. The beetle lays her eggs inside the folded leaf, cleverly fastens down the outer fold upon the first, seals up the bottom of the home, then gives a sharp bite to the upper part of the midrib, to make the entire leaf limp and easy for the baby beetles to eat when they are hatched. Then her work is done. The little ones will never see their mother, but when they issue from the eggs they will find the wilted leaf that she has prepared, and will find it not only a cradle but food. They will eat and be merry, change from grubs into the pupa form, drop on to the ground, and bury themselves in the soil for the winter. Then, in the spring, they will come forth as beetles, and the females will attack other leaves, making fresh homes for their own little ones.

A MOTHER PROVIDING FOR UNBORN CHILDREN

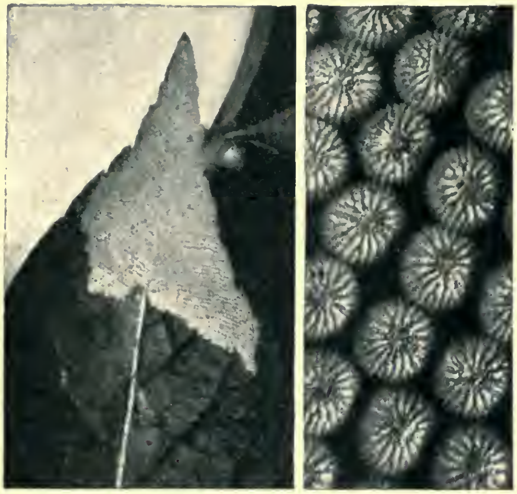


THE NEST MADE BY THE SAND WASP FOR ITS YOUNG—A GRUB EMERGING AT THE END

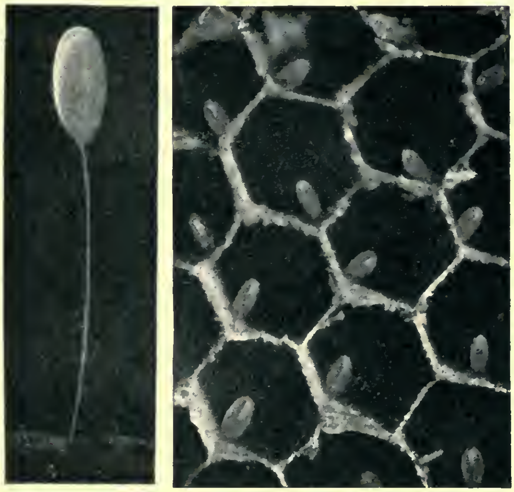


THE STORE OF CATERPILLARS LEFT FOR THE YOUNG BY THE MOTHER SAND WASP. EACH CATERPILLAR IS STUNG TO KEEP IT ALIVE, WITHOUT PAIN, UNTIL THE YOUNG ARE BORN

AN ANT'S NEST IN THE DEEP WOODS



THIRTEEN HUNDRED MOTHS' EGGS ON A LEAF, AND EGGS LARGELY MAGNIFIED



THE LACE-WING MOTH'S EGG ON THE END OF A STALK, AND WASPS' EGGS IN A PAPER NURSERY

THE CRADLE OF A BEE MADE FROM A LEAF, AND A GRUB FEEDING IN IT

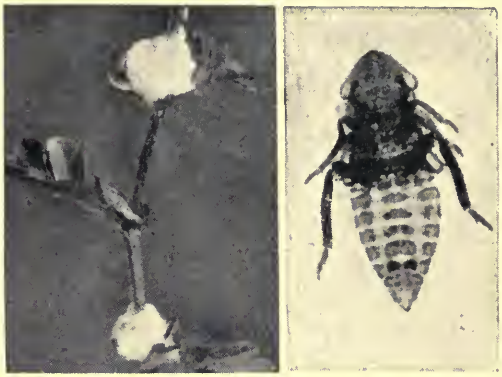
But it is not all insects, of course, who never see their children ; many insect parents have the joy of seeing their babies about them. Some spiders carry the eggs about with them in a little yellowish-white bundle of silk, and great is their distress if they misplace it or if it is taken from them. If an insect can show joy, the mother spider surely shows it when she finds a little bundle of eggs she had lost. When the little ones are hatched, the mother keeps careful watch over them, and shows the most desperate courage in defending them. The time comes when the young ones must go away to seek their own living, but while they are helpless their mother is all in all to them.

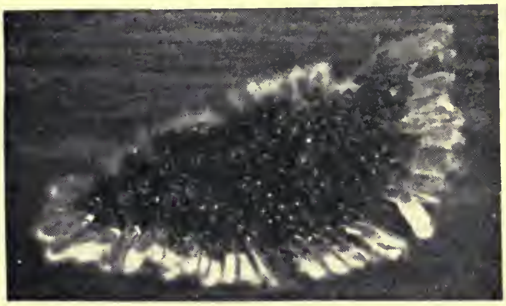
Some spiders are not by any means content merely to guard and guide their babies, but actually carry them about on their backs, so that they may not stray into danger. Two kinds of spiders have really wonderful homes for their young. One is the raft spider, which binds leaves and fragments of weed together, and floats it on water. The eggs are carried on this raft, and the young ones, which in due course will pop out to dine on land just as freely as they will run upon the water, are actually born upon the deep ! The water-spider constructs a lovely little palace of silk actually beneath the water, fills it with air carried down from above, and in this beautiful dwelling lays her eggs. The young ones are born in a silken diving-bell, and the faithful mother rests in her fairy dwelling with them, going aloft only at intervals to catch food and bring down fresh supplies of air.

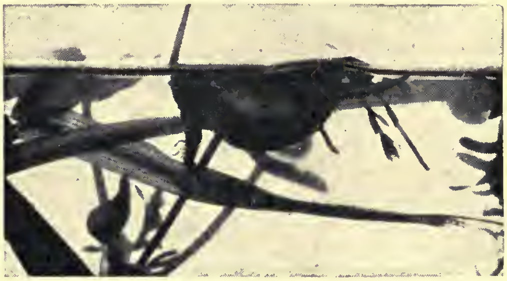
We must all wish that the gnat or mosquito were not so clever and careful in her treatment of her eggs, for while some gnats merely bite and give some pain, certain kinds of mosquitoes carry poison germs which kill millions of people in the tropics. The gnat or mosquito builds a raft. She may make use of a piece of floating leaf, or may make a raft of the eggs themselves. The eggs are cigar-shaped, and are glued together to the number of 200 or more, and stand upright in a solid mass, the heavier part pointing downwards, the light part at the top. Owing to the tiny spaces between the tops of the eggs, it is impossible for them to sink or get wet. If they are driven under water a bubble of air accompanies them, forming a shield for the tops of the eggs, and so keeping them dry. In places where these insects cause disease, men fight them by covering the water with petroleum, which, being lighter than water, floats on the surface, so that when the larvæ come to the surface they are smothered in it.

As the great water-beetle is the monarch of the pond, we might expect it to lay its eggs in the water, as the mosquito does ; but it does not. The mother beetle weaves a wonderful cocoon, which contains upwards of a hundred eggs. This cocoon she places on the soil by her pond, carefully hidden, in such a position that the larvæ, when hatched, can enter the water as soon as they desire. The larvæ pass their infancy in the water, but to make their change into the chrysalis stage they have to go ashore again, and bury themselves in the damp earth, finally to emerge as winged beetles, equally at home in the air, on the surface of the water, or down in the depths, handsome and interesting to all but the living things which they seek as prey. The common smaller water-beetle makes for itself a charming cocoon of silk for her eggs actually in the water. The eggs do not need their gauzy little yacht to enable them to hatch, for they come to life in the water ; but the silken covering protects them from carnivorous creatures, and that is why the painstaking mother labours to prepare this dainty cradle for them.

So far we have found that only female insects look to the care and upbringing of the children, but in certain "sea-spiders" (really marine crustaceans), known as the Pycnogonida, the males are the nurses. In these the males carry the eggs attached to their legs until the baby spiders are hatched. Generally speaking, however, the mother is solely responsible for making the home and providing for the future of the little ones. Even when the mother insect does not trouble herself with the task of rearing her family, she has to undertake the great responsibility of finding the exact position in which her children will thrive. The mother scarabee, or sacred beetle, of which the common dor beetle is a cousin, displays the greatest skill in her effort to preserve her little one from death before it is old enough to withstand the rough usage of the world. These beetles, which the ancient Egyptians regarded as sacred, eat unpleasant forms of food, but prepare a special compound for their young. The food is formed into a little sphere, and the small egg is placed in the food, but at the extreme end of the mass, and at that end a tiny opening is left, not actually bare, but guarded by a fine lattice-work, just enough to admit air. The rest of the food supply is coated with a hard substance


THE CUCKOO-SPIT, AND THE LITTLE FROG-HOPPER (MAGNIFIED) WHICH IS BORN INSIDE IT


AN UNSINKABLE RAFT OF 200 EGGS MADE BY A MOSQUITO (LARGELY MAGNIFIED)


THE FLOATING COCOON OF A WATER-BEETLE, WITH VENTILATING CHIMNEY. A LARVA IS EMERGING

EGGS OF THE PRIVET HAWK-MOTH AND THE CHRYSALIDS, WHICH LIVE UNDERGROUND IN WINTER

The above photographs, and many more in these pages, were taken by Mr. J. J. Ward. Others are by Messrs. Hinkins & Son.

resembling clay, and the whole is placed in a tunnel under the ground. Unless the site were carefully chosen, and the food-mass encased in clay, the heat from the burning sun would dry up the ball of food, so that the grub would starve in its cradle. A brilliant French naturalist, M. Fabre, has recently given us the remarkable story of this insect in full, and for the first time has shown that the ancient Egyptians were right in believing that the little scarabee comes from this ball of matter.

HOW THE LITTLE LACE-WING FLY DECEIVED THE BRAIN OF MAN

The beautiful little lace-wing fly, which when grown up looks like a tiny moth, must have a foremost place in our catalogue of wonderful parents, for not only is she clever and good in respect of her children, but she is a real friend to man. She has to find not merely the right plant, but a plant well stored with the scale-insects, which form the food of the lace-wing larvæ. The mother then, selecting the site, drops upon a leaf, and produces from her body a gummy bead, which she attaches to the plant. Then she gives a jerk, and the bead is drawn out into a fine thread, which instantly hardens into a delicate but firm little stem. Upon the top of this stem the lace-wing's egg is laid. If scales be numerous, the lace-wing will deposit several eggs in the same place, each upon its own stem or stalk. Naturalists, seeing these curious little collections, used to think the eggs mounted upon their stems were a species of moss, and actually entered them in their lists as a moss with a name of its own. So the clever little lace-wing deceived the brain of man.

THE THIRTEEN HUNDRED EGGS LAID BY A MOTH IN A SINGLE NIGHT

Care of another kind is exhibited by the yellow underwing moth. As our photograph shows, the mother moth has hidden her eggs on the under side of the leaf of an elder-tree. She need not have felt compelled to use that tree, for her caterpillars can eat anything vegetable that is green and not poisonous. But, having found a good site, the moth makes haste to take advantage of it. This one laid 1300 eggs in a single night. Moths kept by the writer have laid about the same number of eggs, but in two or three nightly instalments. The regularity with which the eggs are laid is very striking. How long would it take human fingers so to place them? When we know the speed at which they were fixed to the leaf, we can better understand the feat of the spider in making her 90,000 patches of glue on the meshes of her web in less than an hour. Our little moth has done a more wonderful thing, for each of the 1300 specks that she has deposited is a germ of life contained in an egg stored with food, on which the tiny caterpillar will feed till it leaves the egg to feast on the leaf selected by the careful mother.

How does the privet hawk-moth know where to place its eggs? Its own food is the sweet nectar of the honeysuckle, jasmine, and so forth, and its offspring can live on holly, elder, strawberry, lilac, and ash. Yet privet is its chief food, and to privet, in nine cases out of ten, the mother moth goes. A wonderful caterpillar grows from the little egg, a beautiful light green creature, painted along the sides with lovely heliotrope stripes. But when the time for the change of form comes, the caterpillar descends from its larder, burrows into the earth, sheds the green mantle, and puts on a horny mail of brown, through which we can see the outline of eyes, proboscis, legs, wings, and body.

THE HAND THAT GUIDES THE WORLD AND MOVES ALL THINGS TO A HIGHER LIFE

It matters not where we turn in the insect world, we find the same wonderful suggestion of foresight, provision, and care for the young. Even the cockroach, which we all detest, is careful in her choice of nursery. She may wander far and wide to cold parts of the house in her search for food, but she always goes back to a warm place to lay her eggs. The European earwig, which does so much damage to flowers, may almost be forgiven when one sees the mother with her little ones. She not only carefully guards her eggs, but when the young are hatched she marches them out as proudly as a hen leading forth her chickens. Her progeny numbers from fifteen to twenty, and should they be disturbed during the daytime—they dislike daylight—it is interesting and pretty to see how they scuttle up to her for protection, like chickens running to the safety of their mother's sheltering wings. The earwig is destructive, and it is well she is not American; but she has a great devotion to her young, and a fine sense of the duty due to them.

It is wonderful to find this sense of duty in such lowly creatures, and we find it running widely through the insect world. Whatever we may think of it, or whatever explanation men may give, it speaks of the Mind behind all creation, of the Hand that guides the world, and moves all things towards a higher and nobler and fuller life.

A NIGHT WITH A SPIDER

WHAT THE PHOTOGRAPHER SAW IN THE FOREST AT NIGHT

THE LITTLE WONDER-BUILDER

"I WANT to show you a piece of natural magic," said the writer of this article, turning from the supper-table. The others watched with interest, expecting him to conjure his watch-chain into a piece of radium, or produce a live rabbit from his serviette. But he took up an electric lamp, went softly out of the house to a garden gate, and flashed his lamp upon a spider building a house. "There is natural magic," he said; and he was right.

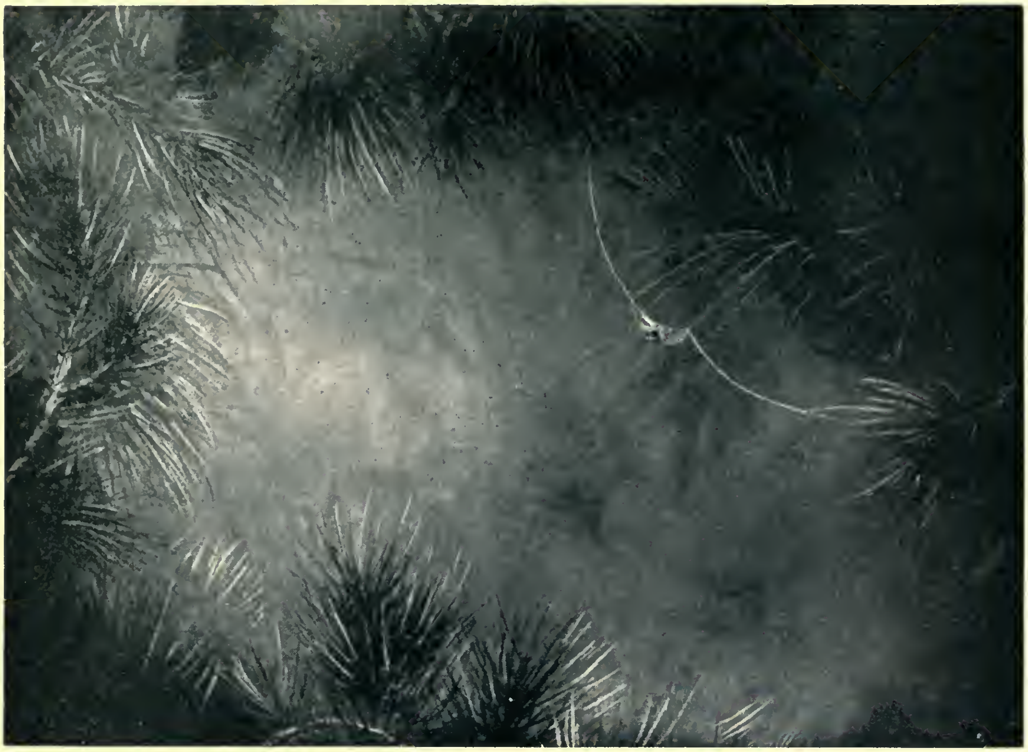
Truly, there does seem a kind of magic in the weaving of a spider's web, that silken snare by which its living prey is caught, the aerial network swaying in the breeze, elastic and unbroken in the presence of wind and dew, stronger than steel of the same thickness could ever be made, and gripping an intruder as firmly as a magnet grips a needle. In daily life a cobweb is a much despised creation, a nightmare to the tidy maid, an unsightly trap for collecting dust. But out in the garden and the woods, where the sunbeams chase each other among the shadows, what a thing of beauty and wonder it is! It grows in a single night. It leaps into existence to bridge some airway down which the busy fly and the whirling gnat are known to take their course, and, frankly, most of us do not know how it came there.

Well, when we are fast asleep at night the spider is in the open, spinning and weaving, building floating platforms with cables and flying buttresses, and every imaginable security against enemies and against the elements. The very commonest of spiders, the big spider of the garden, builds these marvellous webs, and the garden spider's web is the best of all. As every garden has its spider, we may all, if we will but watch in spring, summer, or autumn, see the wonder growing before our eyes.

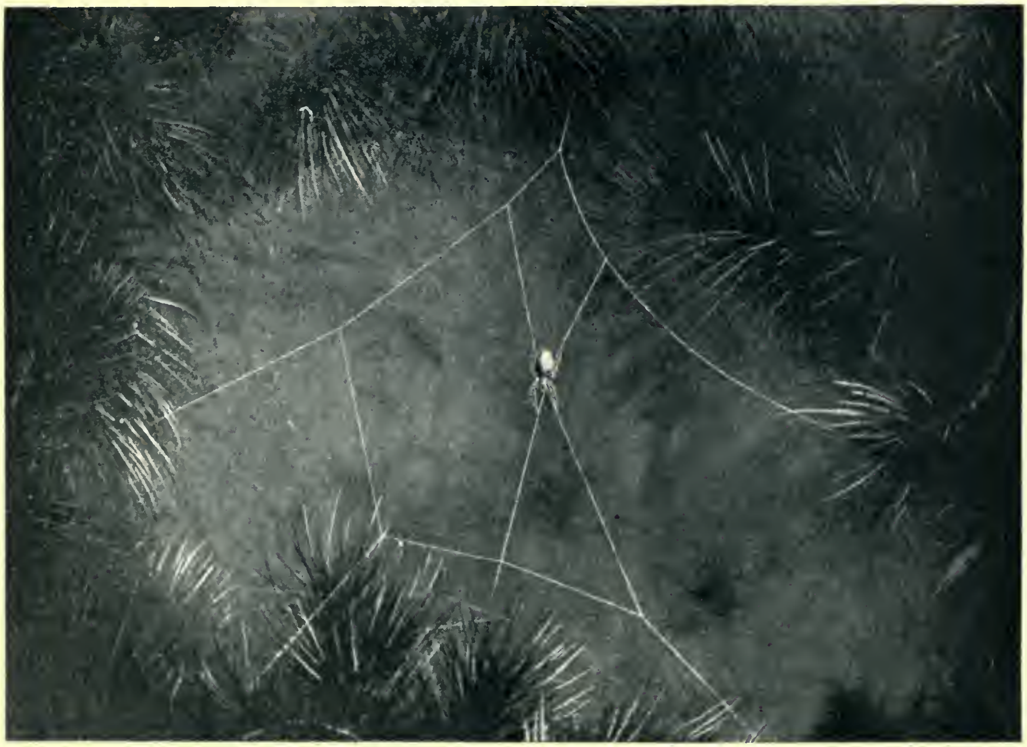
Not long ago some photographers in England spent a night with a spider in the New Forest, which is now old, among the trees and heather, which seem still to speak of William the Conqueror, who laid it out. From late at night till early morning, while a violent storm was raging, the photographers waited, with elaborate flash-light apparatus by which they watched the spider at his work, and photographed her for these pages. About seven o'clock at night Mistress Spider crept from her shelter, under the bough of a noble pine-tree, and with her eight little eyes peered into the darkness of her sanctuary. The picture must have pleased her, for, sitting at the end of the branch which protected her from any direct fall of rain, she was further guarded by the projecting tips of other branches, which carried away any water that might drip from the boughs overhead. Had she known the photographers were waiting she might have felt inclined to hurry her operations, but perhaps she would not. Lady spiders are very uncertain, and have tempers and moods as other ladies have.

Even the husband of a lady spider never knows whether she will receive him in an affectionate embrace or gobble him up! At any rate, our lady spider cared nothing about the photographers. She simply sat down at the end of her nest branch and waited and waited, as if to tire out their patience. Why doesn't she set to work? they asked themselves. Perhaps she was digesting her latest meal. Perhaps she was waiting until her store of silk was fully developed and ready for use. She may even have been feeling a little sulky because the web she had built the day before had been dashed to pieces by the raging tornado of the afternoon. Be that as it may, she sat and brooded for two hours without making any movement. Then, suddenly, she roused herself, drew out some silk from her spinnerets, attached one end to the tip of the branch, and lowered herself a few inches, the line of silk lengthening as

THE SILK THREADS STRONGER THAN STEEL

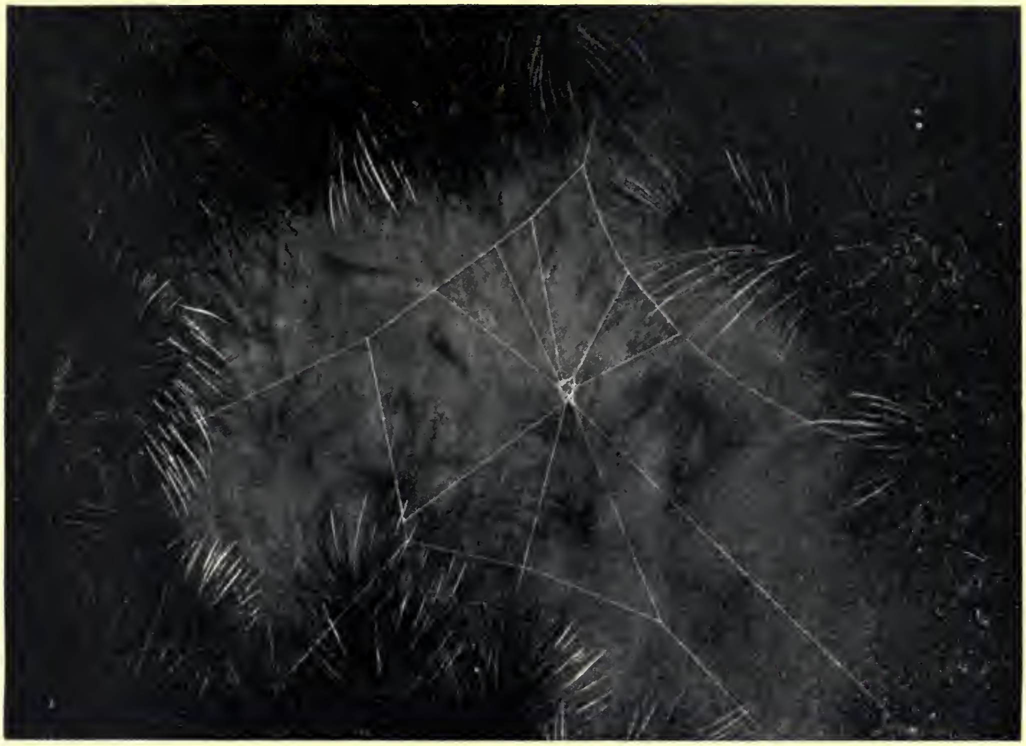


9 p.m. THE SPIDER SWINGS HER FIRST THREAD FAST TO A LOWER BOUGH

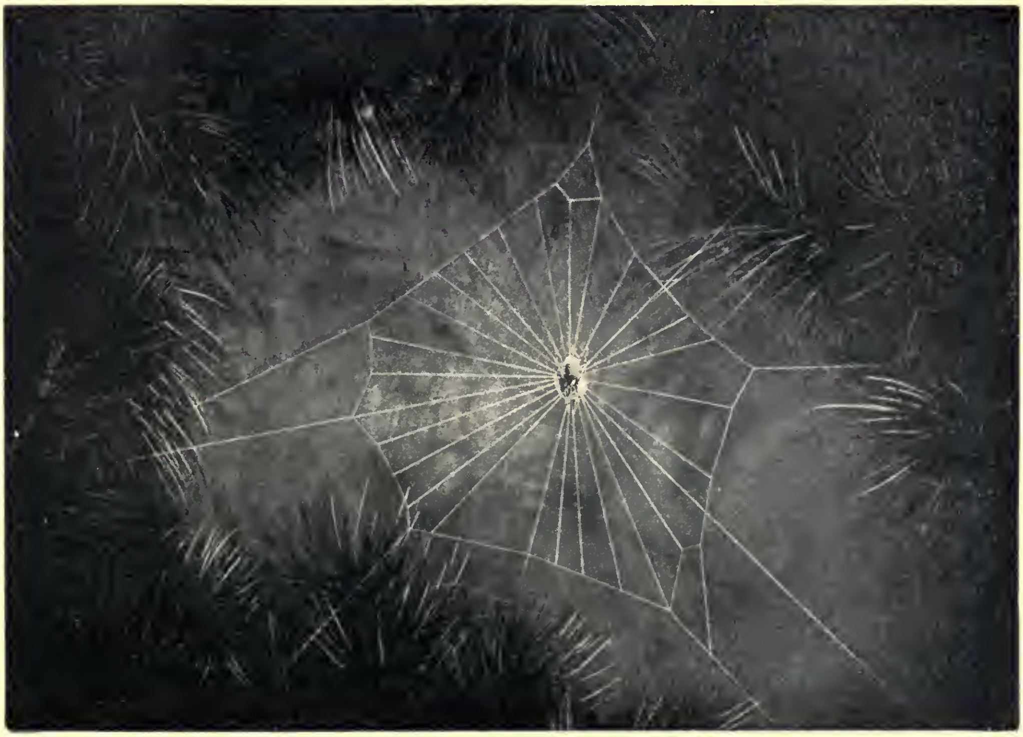


9.50 p.m. THE SPIDER FIXES THE OUTER BEAMS OF HER SCAFFOLDING AND BEGINS THE CROSS-LINES

THE SPIDER LAYS ITS PATHWAYS IN THE AIR

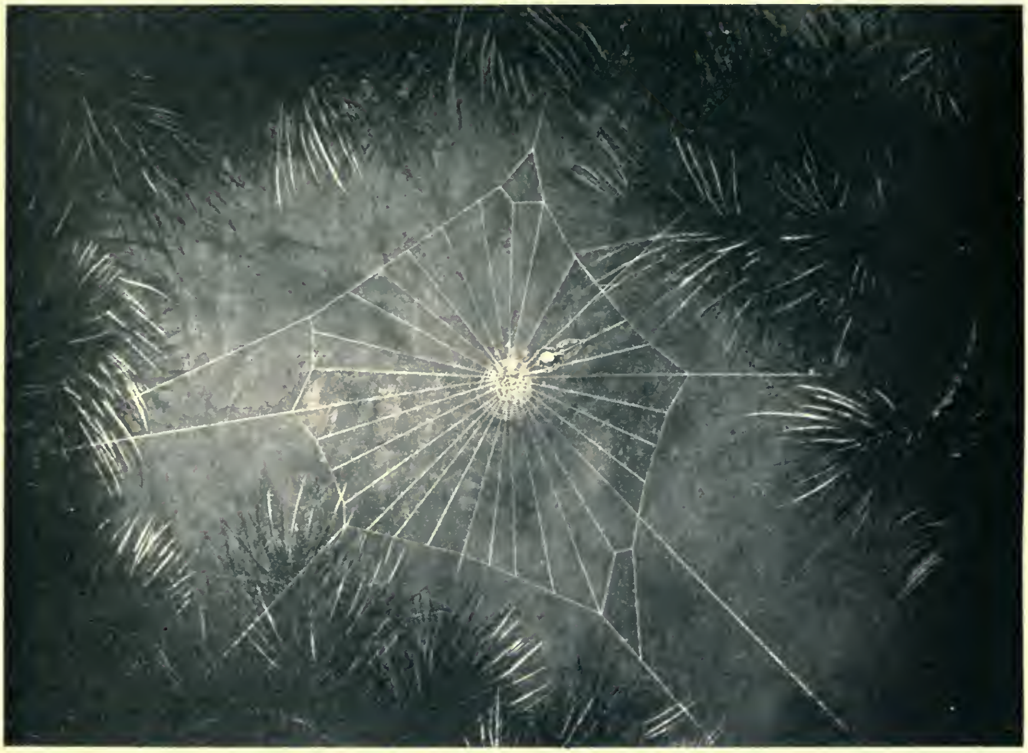


10.30 p.m. AFTER A REST THE SPIDER PROCEEDS WITH HER CROSS-THREADS

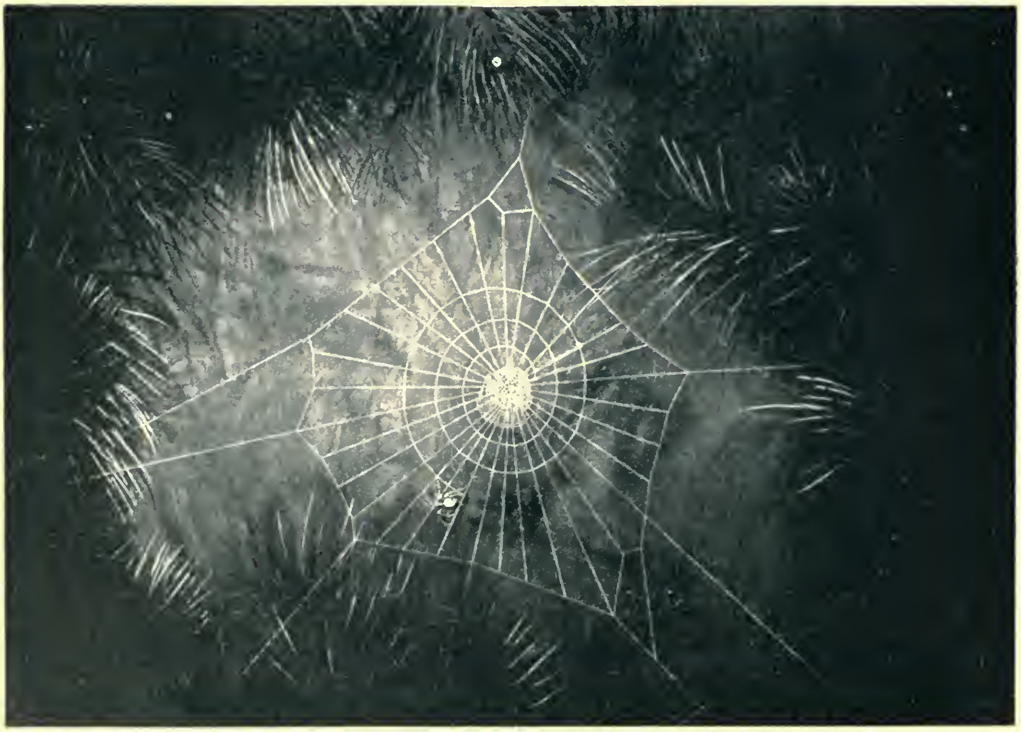


Midnight. THE SCAFFOLDING IS NEARLY COMPLETED, ROUGHLY FASTENED IN THE CENTRE

THE SPIDER STRENGTHENS THE SCAFFOLDING

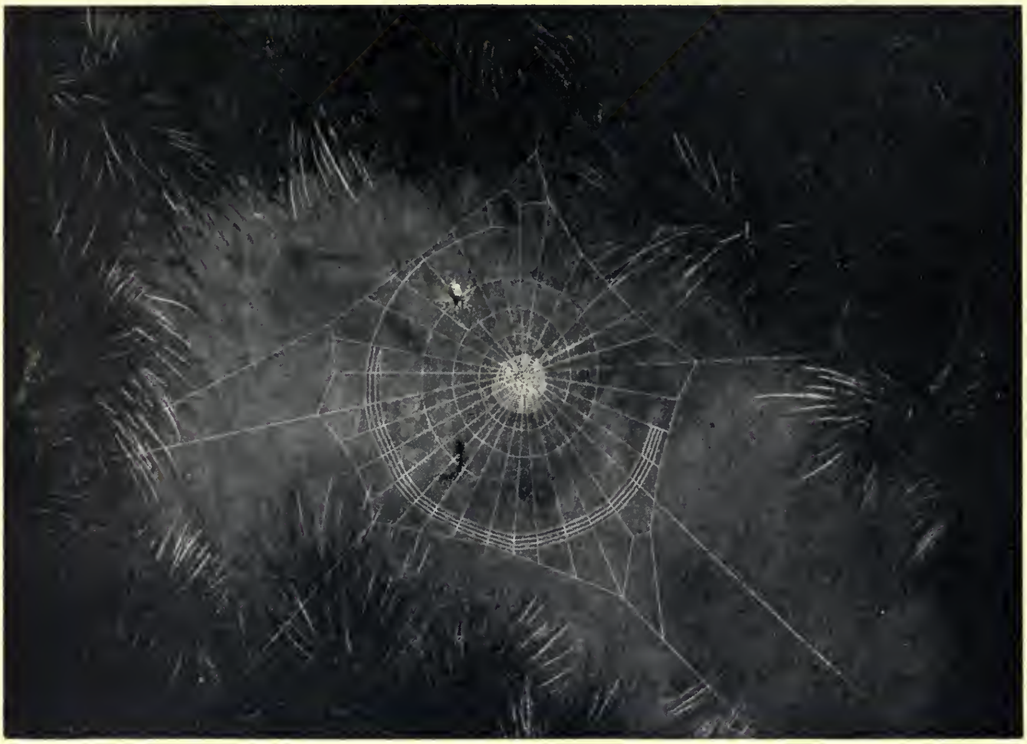


12.30 a.m. THE FOUNDATIONS OF THE WEB ARE FINISHED, AFTER THREE AND A HALF HOURS

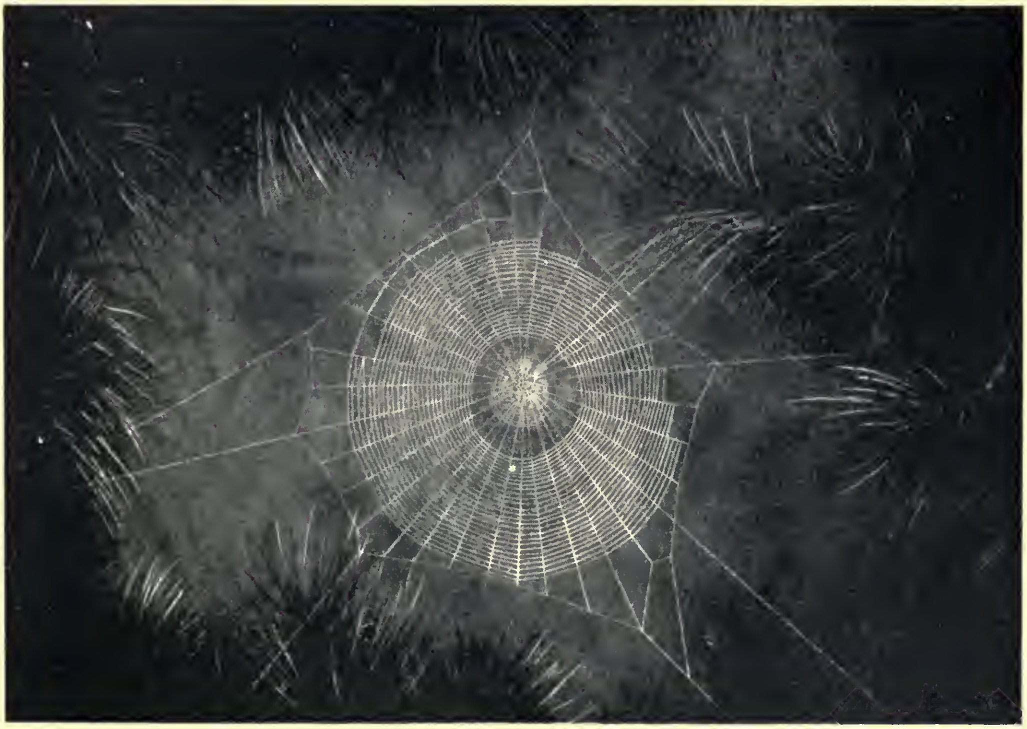


12.40 a.m. THE SPIDER RUNS A SPIRAL ROUND THE CENTRE TO STRENGTHEN THE SCAFFOLDING

THE SPIDER'S BEAUTIFUL HOUSE OF DEATH

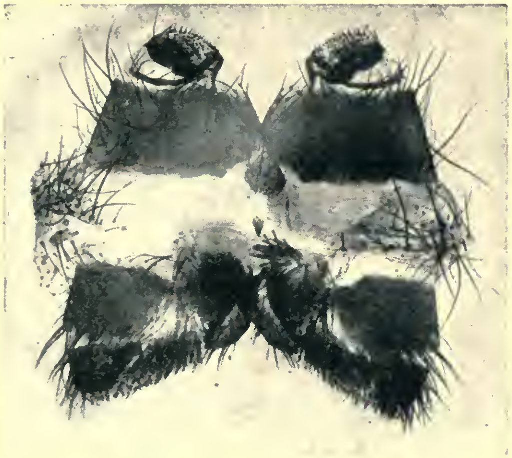


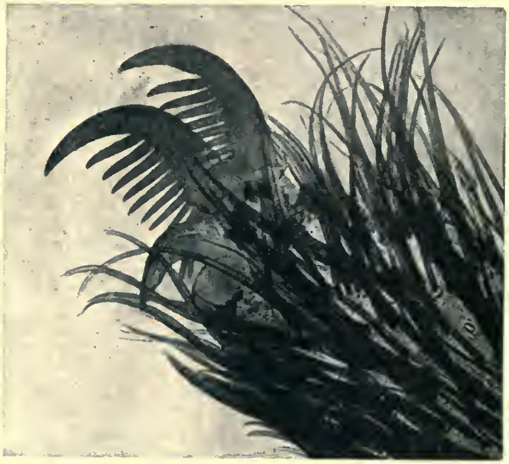
12.50 a.m. THE FIRST OF THE RINGS APPEAR, MAKING THE FINE MESHES WHICH TRAP THE FLY



1.25 a.m. AFTER FOUR HOURS AND TWENTY-FIVE MINUTES THE WEB IS COMPLETED, THE SPIDER HAVING WORKED PERHAPS A FULL HOUR she descended. Then she climbed up a little, turned, and, clinging to this single strand of silk, sat head downwards, thinking, we may suppose, for a quarter of an hour. Was she studying the weather, and deciding what sort of web would best meet it? That we do not know, but the photographers observed that, of several webs that she made during several days, no two were absolutely alike, each seeming adapted to meet the conditions of the day.

After a while the spider leapt from one branch to another, carrying the thread after her, and then she settled down for another reflection at the point from which she had started. This lasted only ten minutes, and then she popped out from her branch, spun out more web, dropped swiftly to the branch below, and fastened the other end there. In two hours and thirty-five minutes she had made the first line of her net. As a garden spider in a hurry can complete a perfect web in an hour, we shall see, as we go on, how moody was this one out in the wilds of the New Forest, with the thunder pealing over her head. Perhaps, after all, the thunder was responsible. As she was so long in getting to work, let us imitate her for a moment to consider the mystery of her spinning and weaving.


THE SPINNERETS FROM WHICH THE SPIDER DRAWS ITS THREAD—LARGELY MAGNIFIED


THE COMB-LIKE FEET WITH WHICH THE SPIDER MOVES ABOUT ITS WEB—LARGELY MAGNIFIED

Her material is as fine a silk as any in the world. If there were enough of it we should use it in commerce as we use that of the silkworm. When a boy first gets his microscope, he sets to work, perhaps, to examine a spider. He thinks he will find coils of silk in its body. But, to his disappointment, he discovers only a quantity of dark, thick, sticky fluid. It is hard for him to believe that that substance, when it leaves the spider, is still fluid, and that the action of the air, and the rapid brushing and pulling action of tiny hairs upon the spider's legs and feet, draws it out into the silk that we see our spider spinning before our eyes.

Yet that is so. A spider drops down in front of us, anchored to a cable of silk, and that cable of silk was a moment before simply a sticky substance inside the spider's body. It would be incredible if we had never seen it. But we have seen it, and men have copied the art of the spider. The artificial silk now sold is made by ingenious machinery on the plan the spider follows.

But the marvel is that all the spider's stock-in-trade is contained within its body. She eats a fly, and changes it into nourishment and—silk! Exactly the same kind of food gives the swallow its marvellous flight, the chamæleon its changeful flush. Here, in the case of the spider, the result is silk. By this time the spider has made up her mind to go on with her task, so let us do the same. So far she has got a single cable anchored at both ends, one end to the upper branch from whose shelter she emerged, the other end to a branch below. She now let herself down to another branch, attached another cable, and, climbing up, fixed two more. Then she returned to her nest, and, poising herself on the tips of the foliage, started a line of silk flowing into the air, for all the world like the baby spiders, who, in order to get away from the enemies who would eat them, spin lines of silk into the air and let the wind carry them off, fastened to a flying cable, where it will. But our lady spider is not doing that; she is not afraid. She is infinitely wise. A wind is gently fanning the pine-trees. It is blowing from the right, and she wants a cable across a little gulf to the left, to bridge a space there and give her a new pathway. Her plan works well. She spins out the right quantity of silk, just the proper length to reach the distant branch. The wind blowing from the right puffs the delicate thread outwards to the left. The line of web becomes attached to the branch it touches. The little engineer has thrown a bridge across the void, without moving from her position, and the wind has been her ally. Think of what this means. The observers, watching carefully, see that, with the wind blowing as it does, there is just one point in the spider's sanctuary from which a cable can be safely launched. That point is the very point at which the spider has stationed herself; from no other could the strand have reached its place. Let us not be too sure that our spider does not reason in some dim, humble way; let us not loftily declare that it is all mere instinct.

The spider has now set up the bare scaffolding of her house. It consists of two upper and two lower lines, meeting at a rough-and-ready sort of centre. She was satisfied with her work as far as it went, and sat at the centre of the web for a time, head downwards, resting before grappling with the more delicate architecture that was to follow. After twenty minutes the spinner suddenly awoke to her responsibilities again, and had a busy quarter of an hour. In this time she fixed most of the supports of the web and no fewer than nine of the radiating lines, or beams, as we may fairly call them. This little dash shows how quickly a spider can work when she settles down in earnest. Another five minutes' rest in the centre of the web led to a further twenty-two minutes' arduous work, and in that time she fixed the right-hand support and thirteen more of the radial threads. Another short rest, and then the last of the thirty-one cross-threads was in position.

Let us now glance at our diagram showing these radial lines. They are numbered to show us the order in which they were made. It will be seen that not one of them crosses from side to side as an unbroken thread, but all meet at the centre, where they are joined to a network of silken links, which act upon one another after the fashion of a spring, giving strength, resistance, and elasticity such as the web could not have if the supporting strands ran straight from side to side. This diagram is well worth studying, for it is perhaps the first of its kind that has been published showing exactly the order in which the little master builder lays the beams of her wonderful chamber in the air.

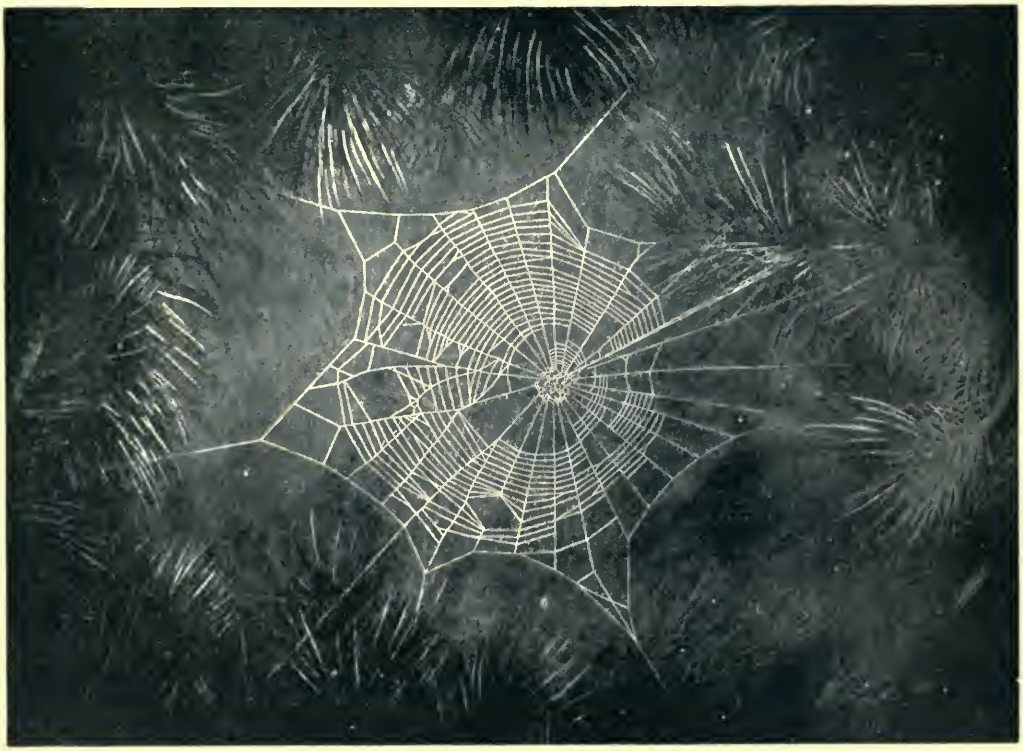
THE WONDER-BUILDER OF THE FOREST
which built the beautiful web as shown in these pages. This portrait is drawn several times the actual size of the spider.

The next thing the spider did was to add a number of small half-rings around the centre of the web to give it more strength. This was done quite quickly, the spider working rapidly to and fro, stopping to fix the web to each line that it crossed. Now there followed a wonderful and beautiful piece of work. Stationing herself on the right upper-centre, the spider fixed a line to one of the cross-threads and, passing to the left, laid on the thread in the form of a beautiful spiral of two and three-quarter turns. The photograph shows the nature of the work. It was left where our picture leaves it, and its purpose was to sustain the whole structure, tight and secure, while the more serious circling was done.

The silken spiral which we now see had the effect of keeping each radiating beam in position, and of maintaining all at the right distances apart. It served also as a scaffold upon which the spider was now to carry out its most elaborate task—the laying on of the larger coils of web. The spider began at the top of the web, working from crosspiece to crosspiece, and to each piece she attached a section of the circular line. She worked from left to right, from the top of the web. When she had reached the bottom of the web, and had gone far enough to the right, she cut off the web with her front claws, and worked back on a new semicircle, but this time from the bottom of the web, and from right to left, and then back again from left to right.

It will be seen that about a dozen of the outer rings of silk are incomplete. When this number had been laid on, the spider began a spiral succession of true rings, which eventually joined and completed the large earlier ones. Sustaining herself by her front claws, she gripped the radial lines and the latest circular line, and, bending her body over the part to be next treated, drew out the silk with her hind claws—using each hind claw in turn—and fixed the end with a light touch to each radial line in succession. It was noticed that while this part of the work was in progress, the spider always poised herself in such a way that her weight was thrown upon that part of the web which had been strengthened, another sign, surely, of something like reason.

The work was finished nearly four and a half hours from the moment at which the spider first began to spin, and about six and a half hours from the time at which it first left its nest on the under side of the branch. She was now mistress of one of the most perfect homes imaginable not made with hands.

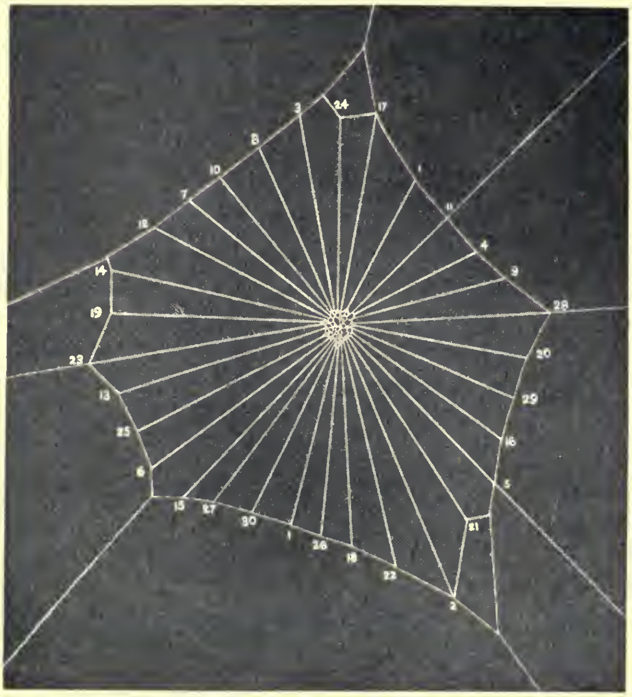


A SPIDER'S WEB AFTER A DAY'S WEAR AND TEAR IN WIND AND RAIN

While the circular lines were being laid on, a new wonder presented itself. Exactly fifty seconds from its laying on, each circle began to glisten and to look thicker. This proved to be due to the running together of many tiny drops of thick, sticky fluid. As she works, the spider not only spins the silk, she produces a gummy substance which makes the meshes of the snare adhere to any insect dashing against it. Without this substance, such a powerful insect as a bluebottle, or a wasp, would strike the web and fly off, possibly breaking the strands. It is calculated that this gum which traps the insects takes the form of ninety thousand little globules when first deposited. These globules, running together, form an entire coating of the circular threads, so that there is little hope for the insect which comes in contact with it.

When the web was finished, the spider, seeing her work was well and truly done, ran nimbly up a little line of silk to the place from which she had first emerged, and slept the rest of the night in peace.

It may well be asked where the husband was all this time, and why he was not at hand to help in the work. He knows better than to offer help, and keeps at a respectful distance from his lady-love. She is a great queen; he is lean and agile, and never seeks her except when he hopes she will be in a good temper, and even then he does not walk boldly into the web and make his bow. He trips up one of the radial lines and gives it a tug. Now, when an insect is trapped, its exertions to get free cause all the lines to vibrate, and if the lady spider is in her retreat, hiding under the branch, she rushes down the web to secure her victim—and then follows a really terrible sight. If she is in the middle of the net, as most likely she will be in the daytime, she leaps round to face the direction from which the shock to the web has come. But when her timorous lover sets the wires in motion, she does not look round. She can read his message. She knows who it is. If she is in a good temper, she will give a tug at her signal line, and bid him come up. He goes, of course, and it depends upon her mood how he is received. If she is really glad to see him, he may stay for tea. If she is only pretending to be pleased, he still stays for tea—but for her tea only—*she eats him.* Male spiders do not live long. They may be gobbled up while still they are bachelors, and they are almost sure to be devoured once the honeymoon is over.



HOW THE SPIDER MADE ITS WEB

This plan was made by our photographers as the spider went on building, and shows the order in which the lines were laid.

So this lovely masterpiece of building is a house of tragedy and death. The lady spider receives her lover in it—and slays him there. She catches her prey in it, and hangs in it during the day, dreamily brooding and waiting for them. She does not sleep in it at nights, nor are her little ones hatched in it. She has another web for these, but this is a sort of cocoon, such as caterpillars make, a tiny cocoon in which pinhead eggs are laid. Thus enclosed, they are carefully hidden until it is time for them to hatch. Some mother spiders carry the eggs about in little white cocoons, like tiny washerwomen taking home still tinier bundles of laundry.

We have been watching only the garden spider. The house spider has quite a different kind of web that is much more closely woven, and is not so sticky. Flies are caught in that through their clawed feet becoming entangled in the soft, close texture of the web. Such a snare would not satisfy the garden spider, whose web faces heavy winds, the weight of dew, and so on. Its web has to be light yet strong, open yet capable of great resistance. The wind may shrill through it, but a fly cannot dart between its meshes; and the dew cannot break it down. Of course, millions of webs are destroyed every stormy day. They become frayed and worn, even without excessive storms, and our photographers took a picture showing us what happened to one such web after the wear and tear of a rough and rainy day in the forest.

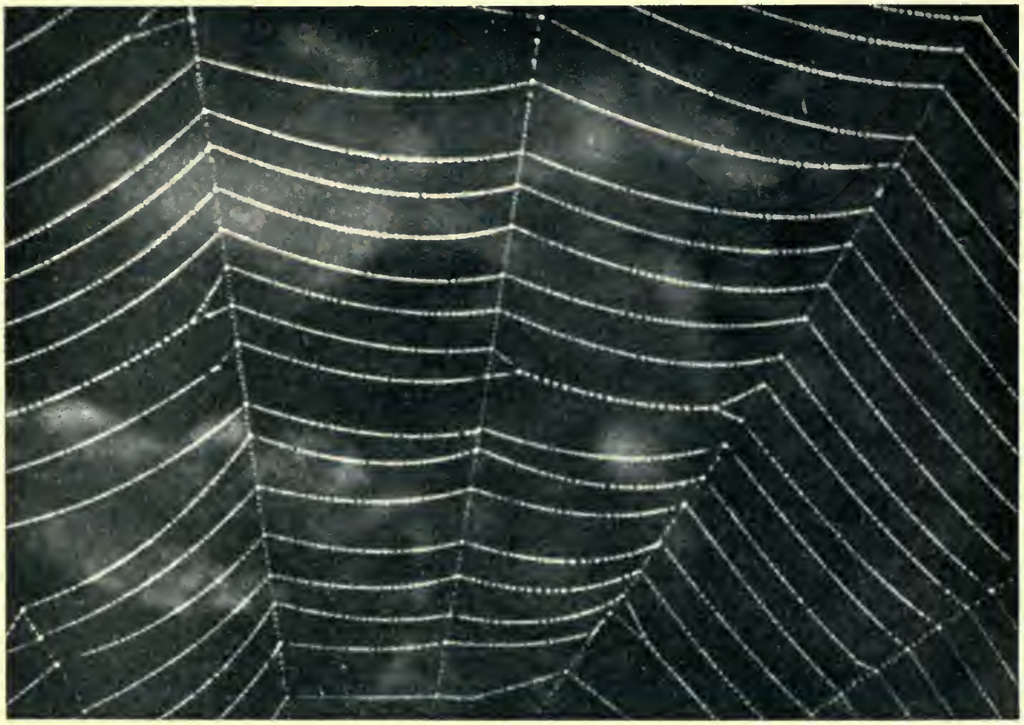
It may reasonably be asked how it is the spider can travel easily and quickly about its web, while other insects are caught and trapped. The answer is that its feet are marvellously adapted for the purpose. They are curiously clawed, like a fine and tiny comb, and their claws grip the lines of the web as certainly and easily as the hands and feet of a monkey grip the branches of a tree.

But *why* these claws do not stick to the gummy web we do not know. The centre part of the web in which the spider crouches, resting, is free from gum. But all the rest of the web is sticky, and the spider has to escape the stickfast which traps its victims.

It is a wonderful little creature that builds houses such as this. If we could trace back its story to the beginning, we should have one of the wonders of Nature made plain before our eyes. We should find that all this wonderful web-building originated in the habit of making the simple little cocoon as a shelter for the eggs, and perhaps as a shelter from enemies for the parent spider.

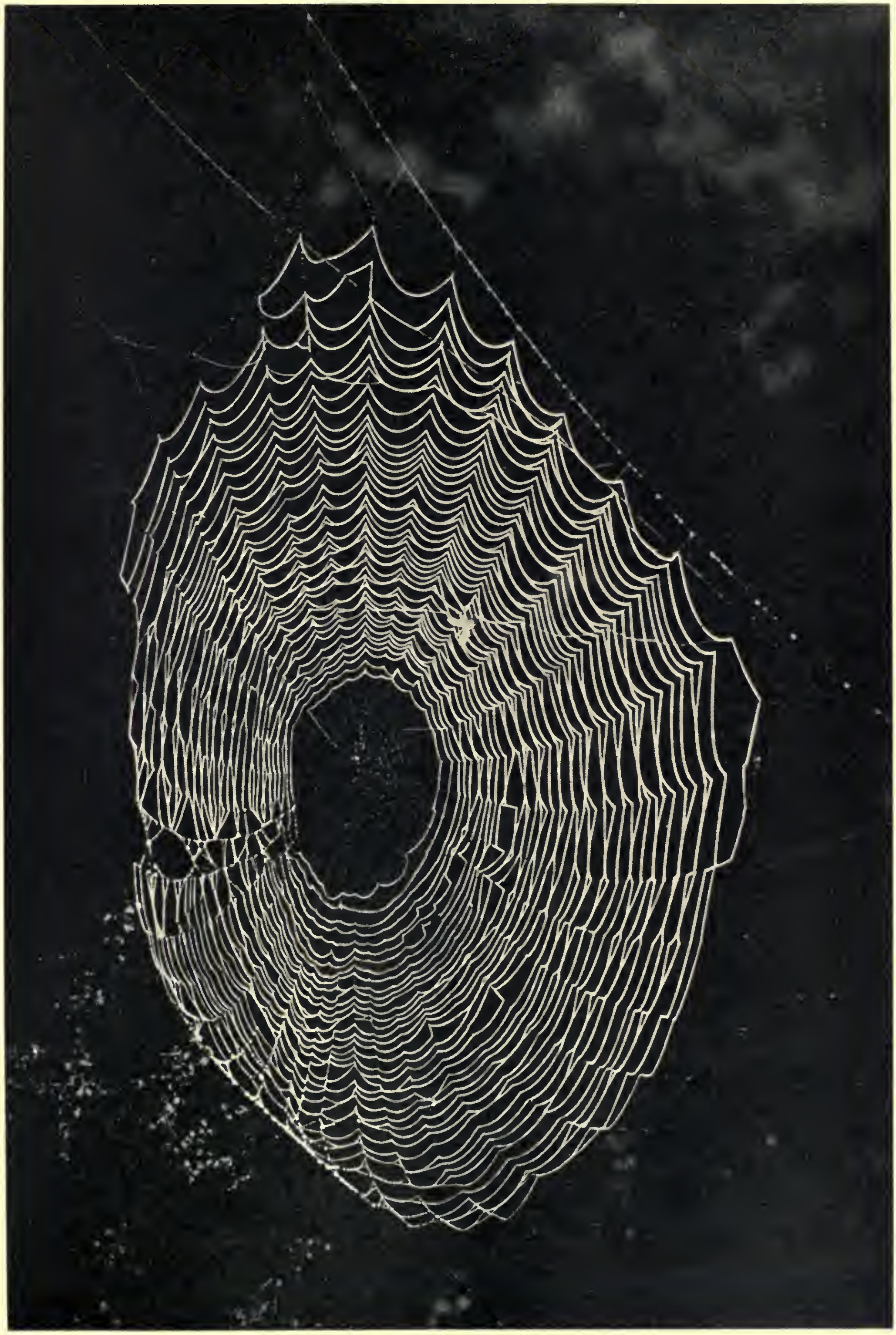
The care of its young which the spider betrays is followed by the heartless act of the cannibal. Yet even that has not been without compensation, for the little ones have learned how to protect themselves from their parents. Many of them have mastered the marvellous trick by which they swing themselves into the air as in a parachute, and the result is that baby spiders, fleeing from cannibal parents, have been blown to nearly all parts of the world, hanging at the end of their little silken parachutes.

They are found in nearly every part of the earth where winged insects are. We find them up on the mountain-side, as high as a fly can breathe and feed; we find them in the trees and down in the ground; in the desert and the wilderness, in islands surrounded by deep oceans which no spiders could swim. They do not all eat flies, nor do they all make webs. Some eat birds and lizards. Some make little underground castles in the soil and protect them with the most perfect trapdoors imaginable, trapdoors hinged with web and fastened securely from within by the same strong yet delicate fibre. Some are wonderful in one way, some in another. But none of them is more wonderful than this garden friend of ours, whose cousin kept our photographers out of bed one night humbly waiting upon her while thunder raged and lightning flashed through the heart of the New Forest.



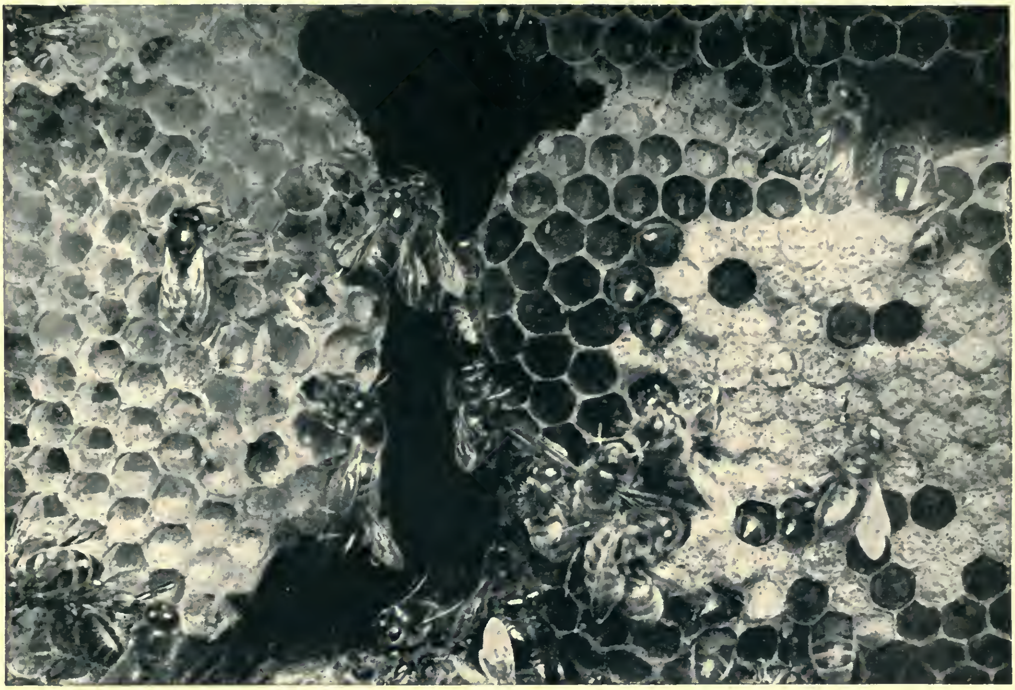
THE STICKY COVERING OF THE SPIDER'S WEB, MADE UP OF NINETY THOUSAND TINY GLOBULES

THE WONDERFUL HOUSE THAT A SPIDER BUILT

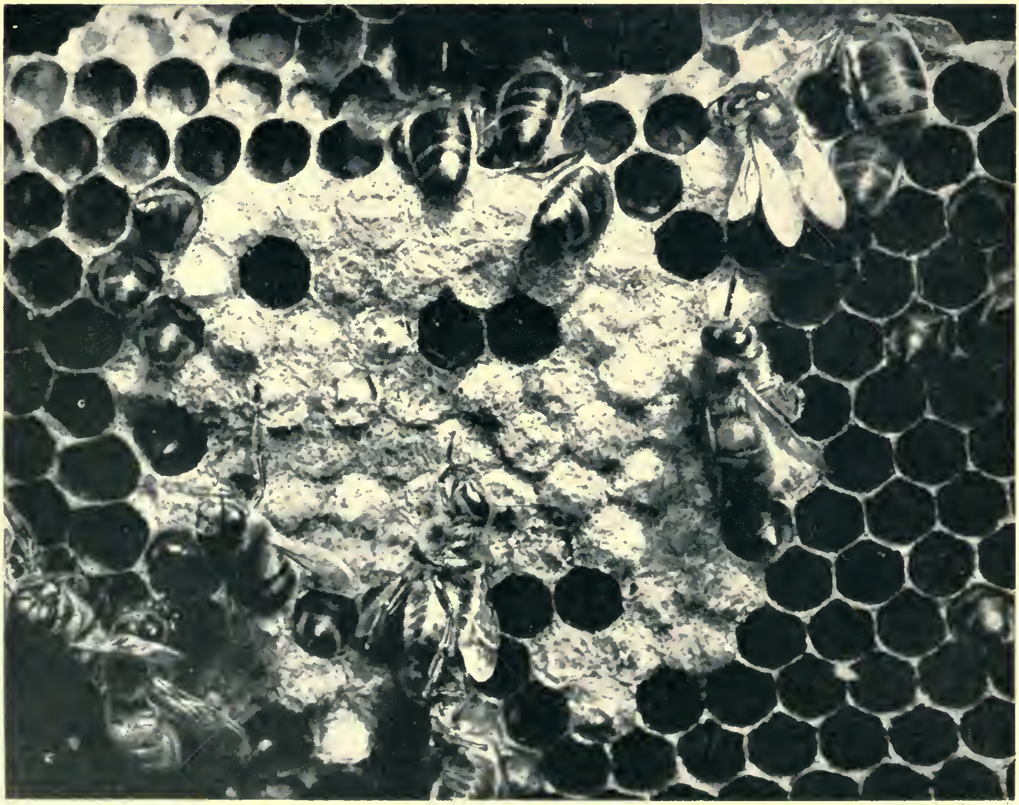


THE SILVER DEW OF EARLY MORNING LINING A SPIDER'S WEB

THE BUSY BEES BUILDING UP THEIR COMBS



THE WORKER BEES MENDING A GAP IN A BROKEN COMB



THE BEES BUSILY MAKING THE COMB IN WHICH THE QUEEN LAYS HER EGGS

THE LITTLE COUNTRY OF THE WISE

ITS THOUSANDS OF ARCHITECTS AND BUILDERS, THE WONDERFUL HOMES THEY BUILD, AND THE LIFE OF THEIR INHABITANTS

WHAT REALLY HAPPENS IN A HIVE OF BEES

If you have ever seen a swarm of bees issue from a hive, fill the summer morning with a cloud of flashing wings and glad riot of music, and then come to rest at last, all the thousands of reckless truants gathered in one dense, silent mass, gently swaying from the branch of a tree, you have seen one of the most mysterious sights in all the round of Nature.

The wonder of it lies not so much in the spectacle itself, although that is startling, but in the fact that the honey-bees, of all creatures on earth, should behave in this surprising way. If the honey-bees were in the habit of congregating in this way on fine summer mornings, returning to their hive after a few hours' enjoyment of the air and sunshine, it would be interesting, yet little more; but that is not what happens. That is not the habit of the bees. This great swarm of theirs is the first they have known, and of the thousands that have issued so jubilantly from the hive, which has been home to them from their first moment of life, not one will ever return. The swarm, from now onward, will become a separate colony of bees; and even if the new home should be within a few feet of the old home, and hard times should come upon it, every bee in the new home will starve, and die at her post, rather than go back to the place where prosperity and plenty await her after only an instant's flight.

Moreover, we are faced with this mysterious thing. Today, before the swarm has issued, the twenty or thirty thousand worker bees, destined to go forth in a few hours, would instantly defend the mother-hive against an assailant with their last energy and the last drop of venom in their stings. But tomorrow, when the new colony has come into existence, not a single one of those bees would stir a wing to save the old home that was all-in-all to them but yesterday, no matter what danger might threaten it. As far as they are concerned, the old home has now utterly ceased to exist.

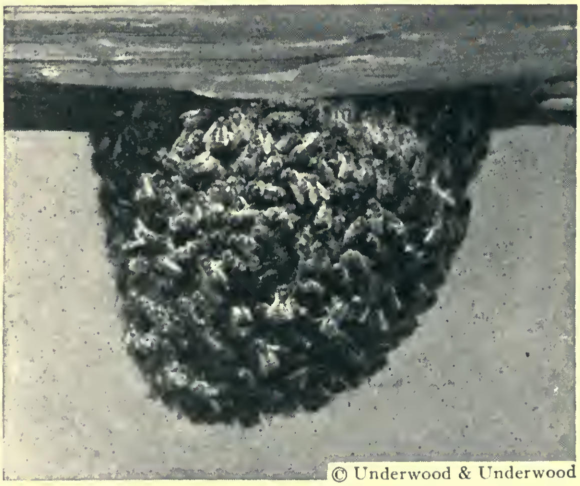
We see the hive at one moment going about its business in a quiet and orderly fashion, and the next suddenly throwing a dark and living stream upon the air. We see the winged multitude flinging itself broadcast overhead in what appears to be a mad confusion. But then we see a common purpose gradually reveal itself amid this chaos. The madly pirouetting, vociferating crew, after sailing about bodily hither and thither against the blue sky, at length seems to be concentrating at one spot. At the tip of a branch a little knot of bees has formed itself, no bigger than a single leaf; but even as we gaze this black spot doubles its volume. A moment more, and it has doubled again, and it grows and grows, as we watch, at amazing speed. We note now that, from all quarters, the flying bees are streaming towards this common centre. In an incredibly brief interval, the air is empty of winged life. Every bee has attached herself to the cluster, and the branch is bowed down with the weight of it, almost to the ground. There it hangs, a dark brown, glistening, cigar-shaped mass, idly swaying to and fro in the sun, while the wild song that thrilled the air a moment before has changed to a silence that is almost uncanny. It is as though a dead calm had fallen in the midst of a storm.

And now let us see what manner of creature it is that has done this thing. For 364 days out of 365 in the year a hive of bees presents an almost perfect example of law and order, prudence, and untiring industry. Every member of the colony—and in the height of summer a colony may consist of fifty or sixty thousand individuals—has its allotted work to do, and does it in a very fever of conscientiousness, resting neither day nor night. The queen, the one mother bee in the hive, passes incessantly over the combs, depositing eggs in the little cells to the number of several thousands in a single day. The worker bees hurry in and out of the hive, bringing in nectar from the flowers, to be brewed into thick, golden honey; or bringing pollen, to be made into food for the young bees when they are only tiny white grubs with staring black eyes lying inert in the cells; or bringing water, which is indispensable at nearly all stages of the life of a bee Even the drones, of which there are only a few hundreds in each hive, have their appointed tasks. The drone is by no means the idle, dissolute fellow he is made out to be in the old-fashioned Nature books. He does not work simply, because he has not been provided with any tools of labour—his tongue is too short to reach the nectar at the base of the flower-cups, he has no baskets on his thighs in which to transport the pollen, he cannot make wax or build up honeycomb. But he has many important offices vital to the well-being of the hive, and these he attends to with enthusiasm.

A MAGNIFIED PORTRAIT OF A BEE

So the hive goes on, day after day, month after month, with neither rest nor recreation for any bee, until the colony reaches its high tide of prosperity in the late spring. The storehouses are full to overflowing; the hive is crowded to the very door with a great population of bees; thousands more are being born every day. And then this strange thing happens. The creatures who have been at such infinite pains to bring about all this fulness and prosperity, whose industry, ingenuity, and self-abnegation have resulted in such an amazing structure, such an abounding accumulation of wealth, appear suddenly to go back on all their long-cherished principles. They throw work to the winds, rush out madly to sport and play, abandon for ever all their hardly-got possessions, and utterly beggar themselves—all, as far as we can see, for the wild frolic of an hour. And tomorrow we shall see them sober and industrious again, as forgetful, apparently, of their wild escapade as they are of the very existence of the home of plenty they have forsaken for all time, beginning life afresh, with a new feverish accession of energy, as they attach the first atom of wax to their new, empty house, and hurry forth to gather the first drop of nectar, or first pollen-loads, to feed the children yet unborn.

We began by considering this marvel and mystery of the swarm, but there is no essential reason for beginning there, for every page in the life-book of the bee is wonderful, and has some bearing on every other page. Each is but a part in a chain, an endless chain of marvels which, followed link by link, will bring us round again to a new contemplation of the wonder we started from.



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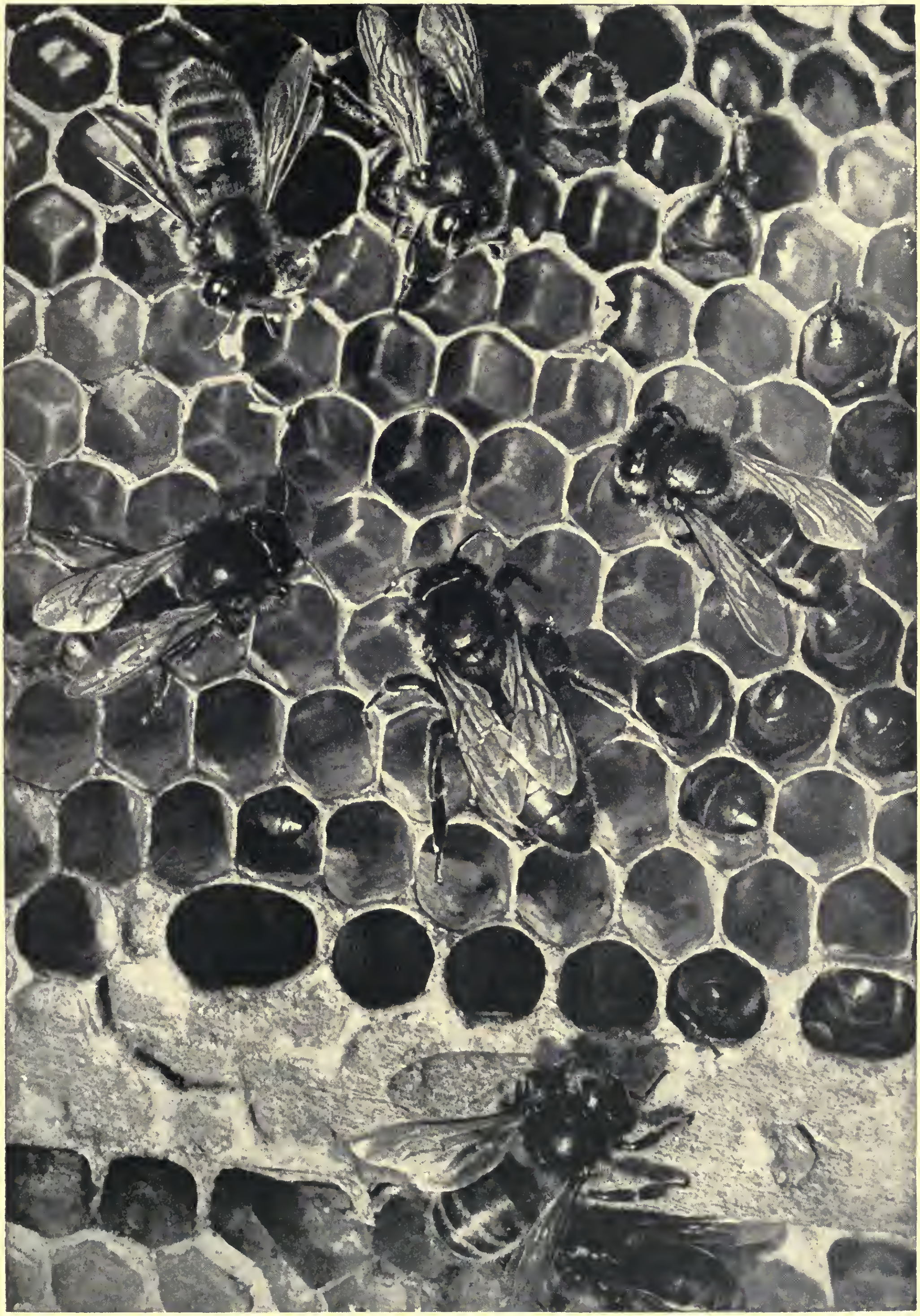
A SWARM OF BEES HANGING FROM A BEAM

Thus the issue of a swarm is inevitably connected with another thing perhaps more curious still. Though a great army of bees has come surging out of the hive, many have remained behind. If we look into the hive immediately after the departure of the swarm, we find there still a great gathering. The ordinary daily affairs of the colony seem to go forward in the old way, in spite of the upheaval. The combs are covered

THE QUEEN BEE AND HER ATTENDANTS

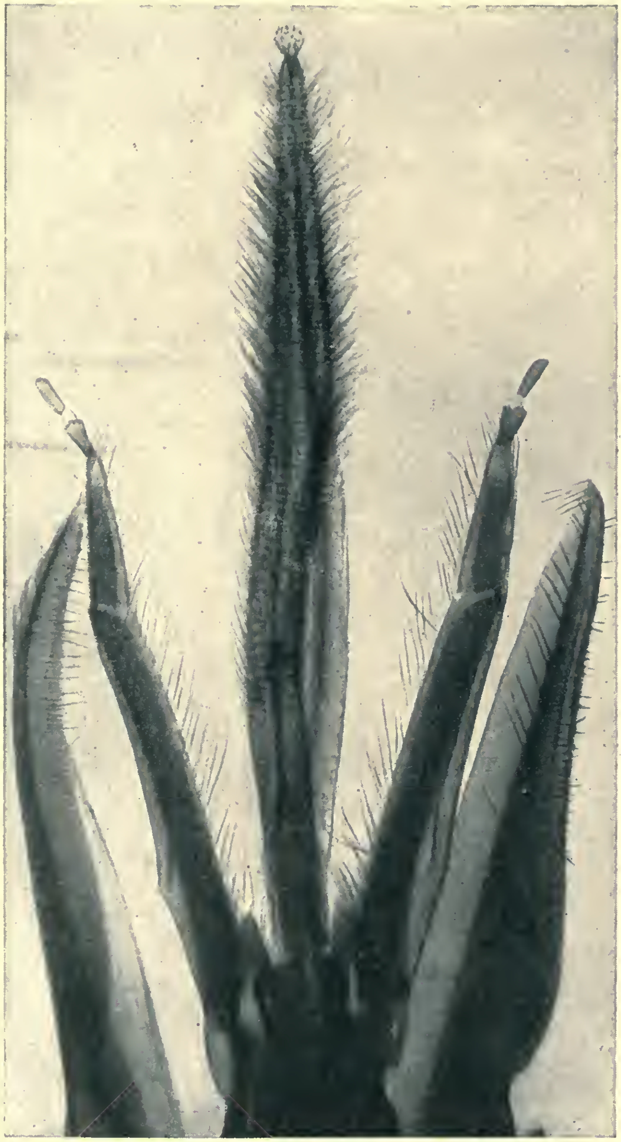


HER MAJESTY OF THE HIVE—THE WORKER BEES ATTENDING ON THE QUEEN, ALL WITH THEIR FACES TOWARDS HER. THE QUEEN IS THE LARGE BEE IN THE CENTRE

The plate facing page 161 is from colour photographs by Mr. F. Martin Duncan. The photograph on page 165 is from "The Lore of the Honey Bee," by Mr Tickner Edwardes. Other photographs on these pages are by the Rev. S. N. Sedgwick, Messrs. Hinkins & Son, Percy Collins, W. Reid, and others.

with bees engaged in the usual occupations —storing the nectar, feeding the young grubs, sealing over the ripe honey-cells, and closing up the cells in which the larvæ have reached full growth. And the question at once rises in the mind—Why did all those bees rush from the home, never to return, while all these others remained at their tasks, apparently unconcerned? By what means were some chosen and the others left?

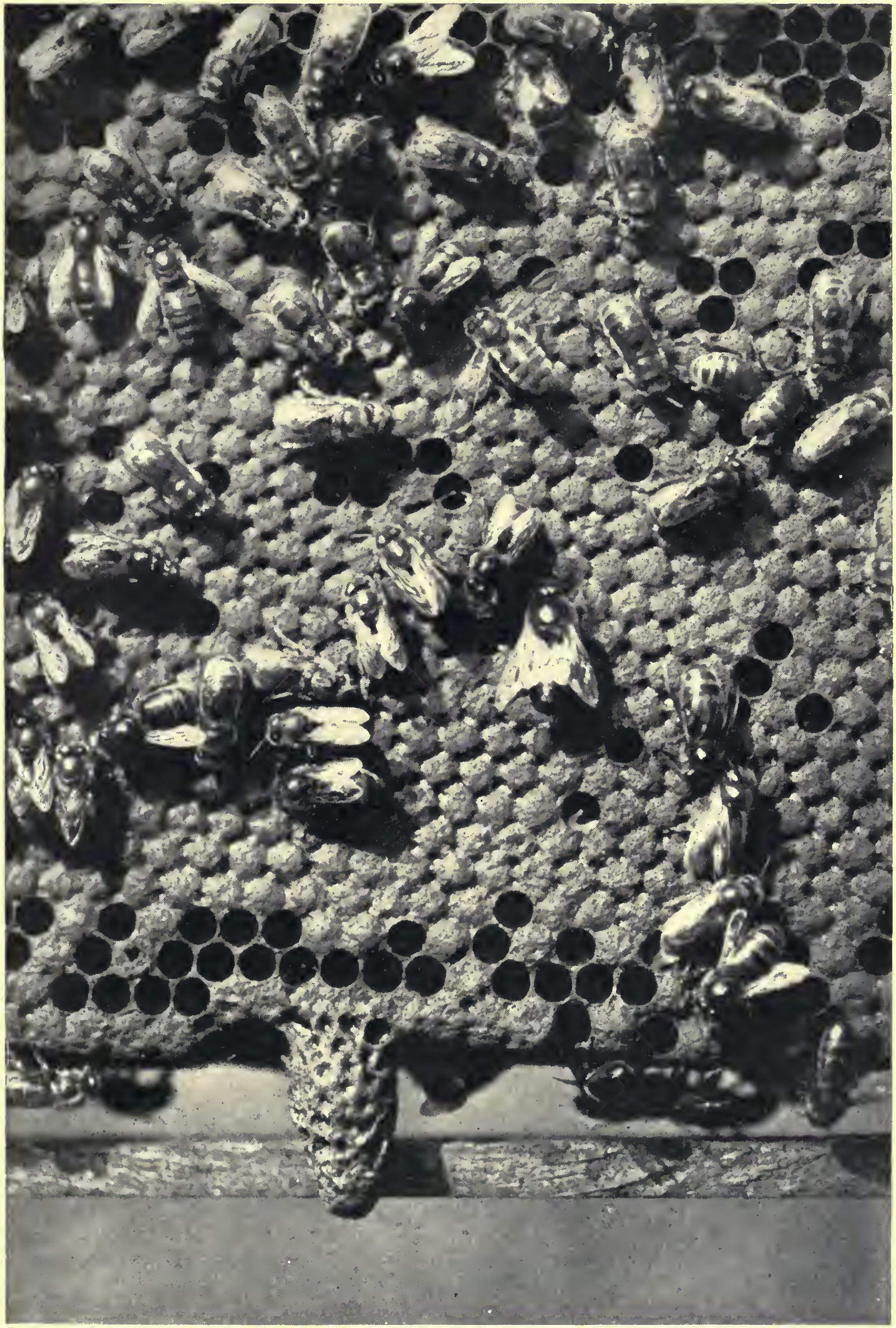
Well, as far as is known, no man has ever been able to answer that question. It is certain that the bees to go are chiefly mature workers accustomed to fly abroad, and that they take with them the queen of the old colony. It is certain, also, that the majority of the bees that remain are young workers and drones, whose experience of out of doors has been mostly confined to short airing flights in the midday sunshine round the hive. But that is all we know — that the stock does divide itself in this way, and the phenomenon must depend on urgent, definite laws — it must fulfil some imperious need, for it is obviously brought about by forces that are instant and irresistible. There is nothing in Nature, perhaps, exhibiting so dynamic a purpose as the issue of a swarm of bees. But why these forces should impel so many thousands of bees to go away, and go away for ever, while the rest remain wholly irresponsive to the sudden call, is a puzzle that has always baffled the wisest man.


THE TONGUE AND MOUTH OF A BEE

Yet, though the life of the honey-bee must ever rouse a spirit of wonder, it is not always fraught with mystery. There are aspects of it that the wisest of us may never come to understand; but, considered as an intelligent system, it is far from being mysterious; intricate and ingenious as it appears to us, its meaning and purpose stand out clear as day. Look where we will throughout the numberless activities of the hive, we see in them all a meaning, and in the end an attaining. We have illustrations of this truth almost without number. There naturally arises in the mind, first of all, the structure of the hive itself. It is impossible to study the honey-bee without arriving at the conviction that in range, power, and quality of understanding she stands in the very front of God's creations; and nothing will go farther to prove this than an examination of the structural contents of a hive.

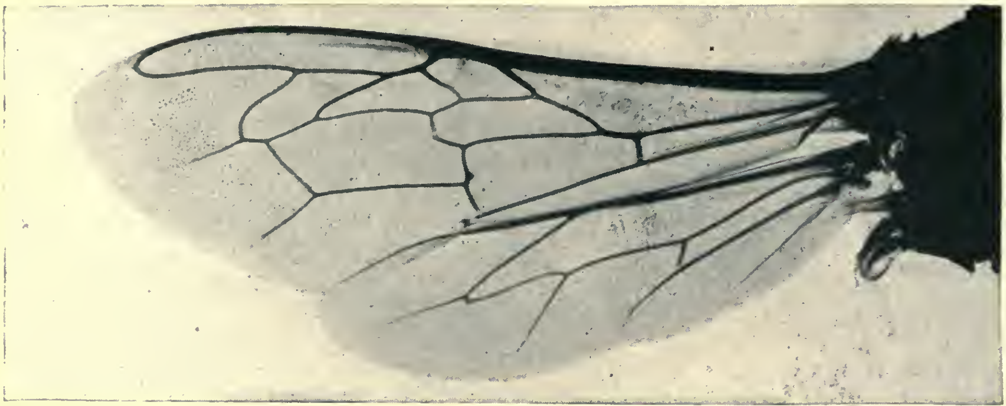
First consider the needs of the case. Bees are ordained to live together in a dense community, all the energy and ability of thousands of individuals united for the common good. What, then, do we see in a hive? The first things we see are the unique systems of rearing the young, and methods of making and storing honey,

THE LIFE OF THE BEE IN ITS WONDERFUL HIVE

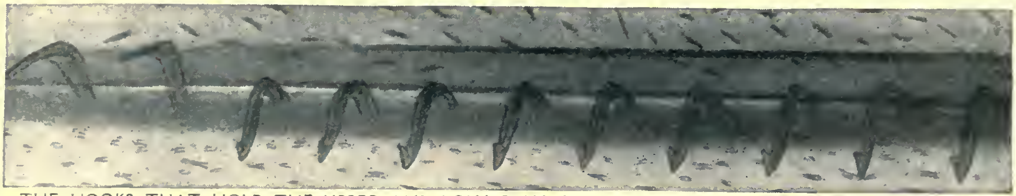


THE QUEEN BEE WHO DEPOSITS AN EGG IN EACH CELL IN THIS COMB, LIVES IN THE ROYAL CELL AT THE BOTTOM which is merely food laid by for the coming winter. For both of these purposes a continuous high temperature is needed, and the hive is therefore a closed receptacle, so that heat may be retained. But this warmth must first be generated and then economised, and both objects are attained by restricting the enclosed space to the least dimensions needed for the combs and the living heat-producers, the inhabitants of the hive. Limitation of space being thus necessary it follows that the cells, which are needed for rearing the brood and storing the honey, must be made of the thinnest material, and of such a shape that they will pack together in the least possible compass. How does the honey-bee solve this problem?

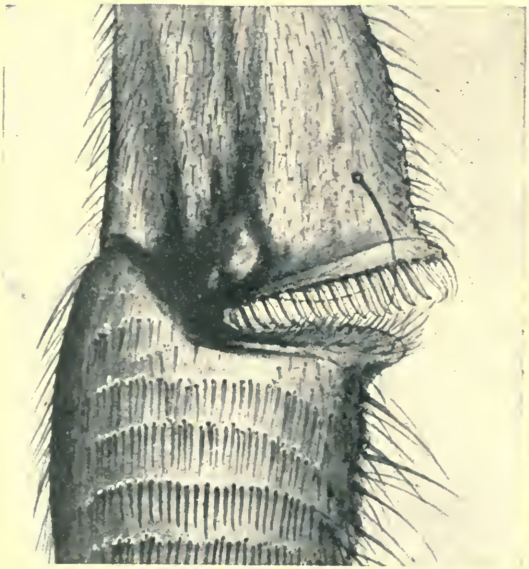
She first proceeds to create within her own body a material which is lighter,



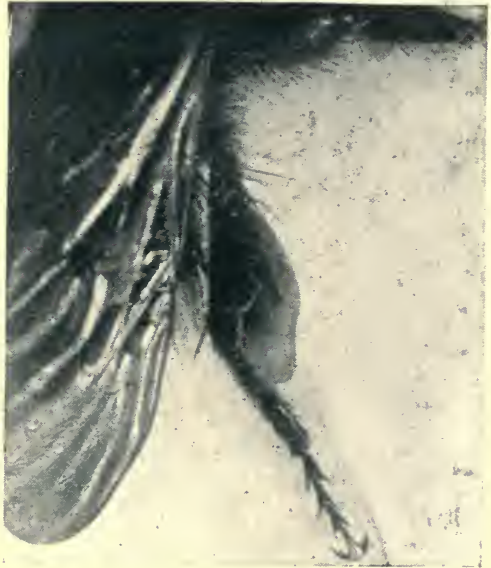
THE UPPER AND LOWER WINGS OF THE HONEY-BEE



THE HOOKS THAT HOLD THE UPPER AND LOWER WINGS OF A BEE TOGETHER WHEN IN FLIGHT

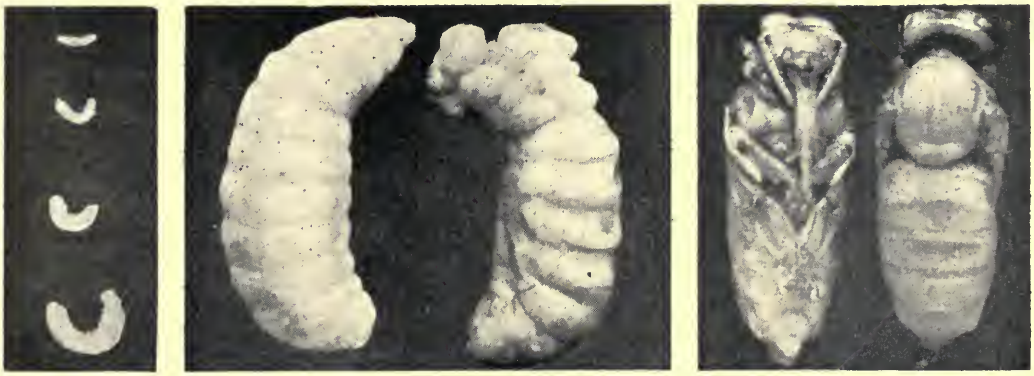


THE EMPTY POLLEN POCKET OF THE BEE, IN THE JOINT OF ITS LEG

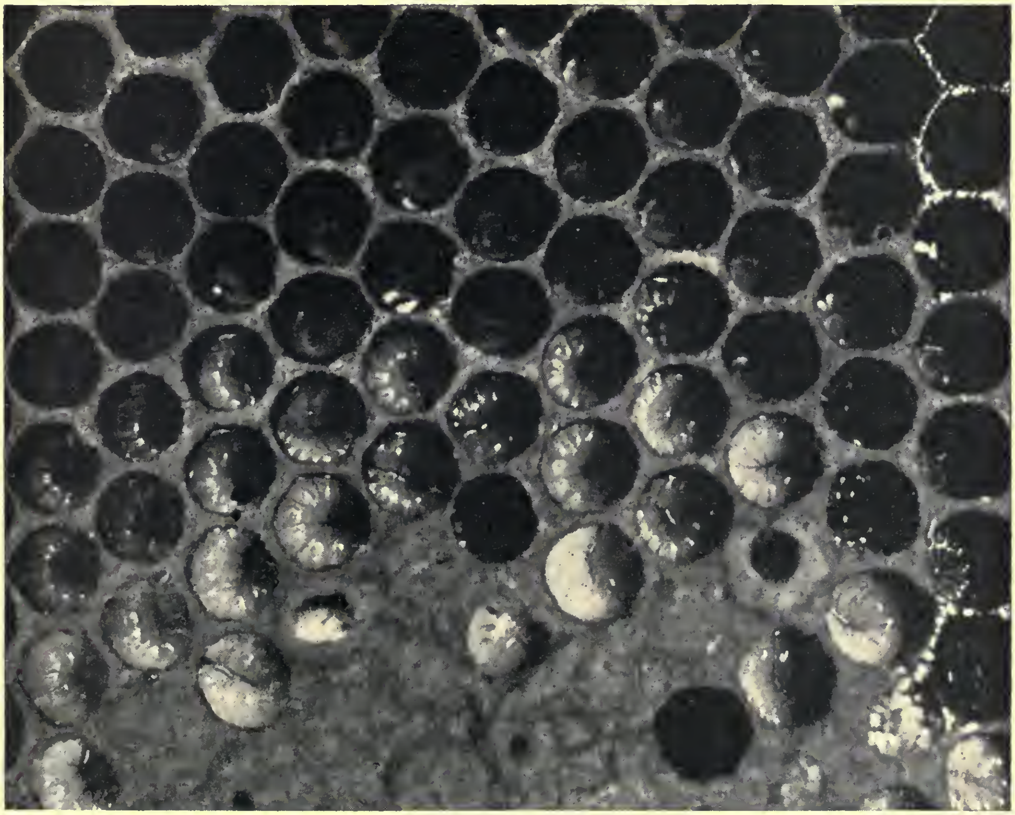


THE POLLEN POCKET OF THE BEE LADEN AFTER A VISIT TO THE GARDEN

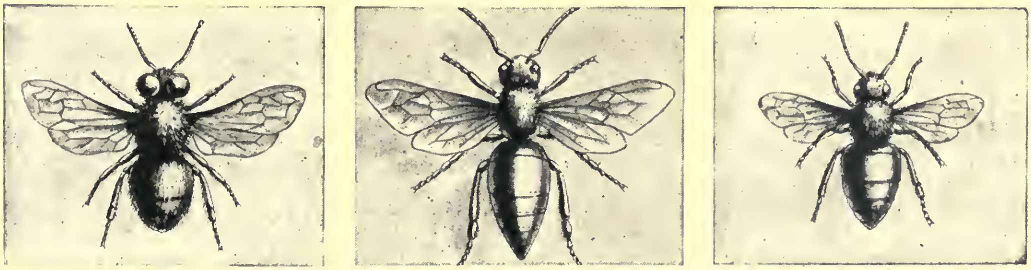
THE GROWTH OF THE HONEY-BEE IN THE TINY CELL



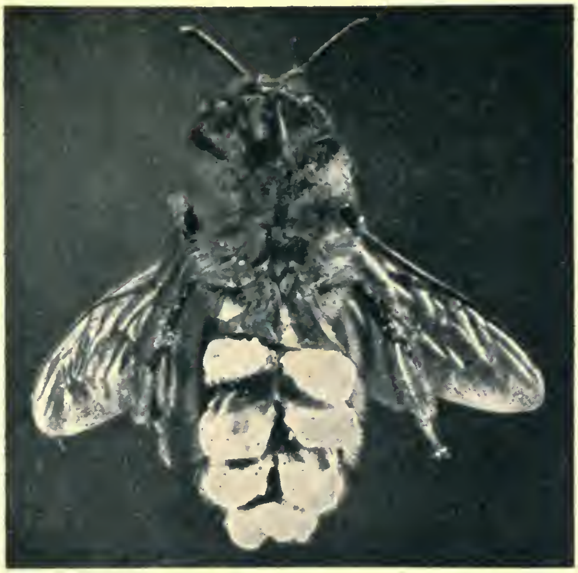
THE DEVELOPMENT OF THE BEE FROM THE EGG LAID IN THE CELLS



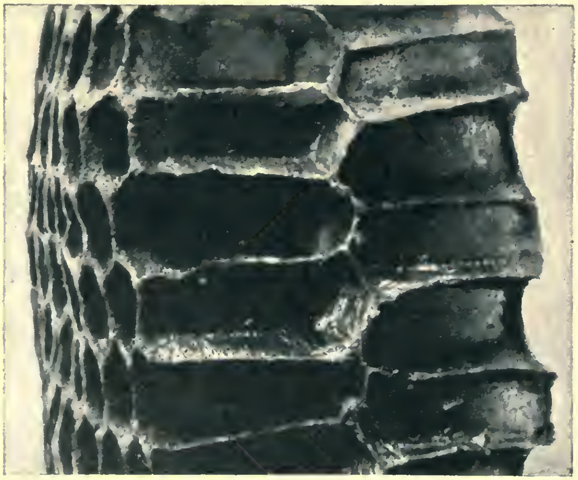
THE EGGS LAID BY THE QUEEN IN THE CELLS, SHOWN IN VARIOUS STAGES OF DEVELOPMENT



THE WISE LITTLE CREATURES THAT EMERGE FROM THE EGGS SEEN ABOVE—THE QUEEN BEE IS IN THE MIDDLE, WITH A DRONE ON HER LEFT AND A WORKER ON THE RIGHT tougher, and more elastic than anything she can obtain out of doors. Then she ascertains the size of cell necessary for a full-sized grub, and proceeds to fashion a series of these cells. She makes each cell six-sided in form, because cells of this shape will fit together side by side over a given surface without leaving any waste spaces between. Moreover, a larger number of six-sided cells will go into a given area than cells of any other shape.


THE WAX PLATES MADE BY THE BEE FOR COMB-BUILDING

And now the bee perfects her scheme for greatest efficiency and economy by two crowning strokes. Every cell must be closed in at one end. Instead of grouping her cells in horizontal planes mouth upwards, as do the wasps, she places them on their sides, building a vertical wall with them, and sets two of these walls back to back, so that one partition will suffice to close two cells. But a still more ingenious economy in material is now brought about. Instead of making the cell-bottom flat, the bee constructs it of three diamond-shaped plates which fit together, forming a blunt pyramid. The result is that the cells, while retaining their necessary length in their centres, fit together where they meet back to back, like the teeth of a rat-trap, overlapping each other, and thus a considerable saving in both space and material is effected. The whole device is a veritable triumph of mind over matter, and the comb of the honey-bee exists today, in this age of mechanical wonders, as one of the most ingenious mechanical contrivances in the world.

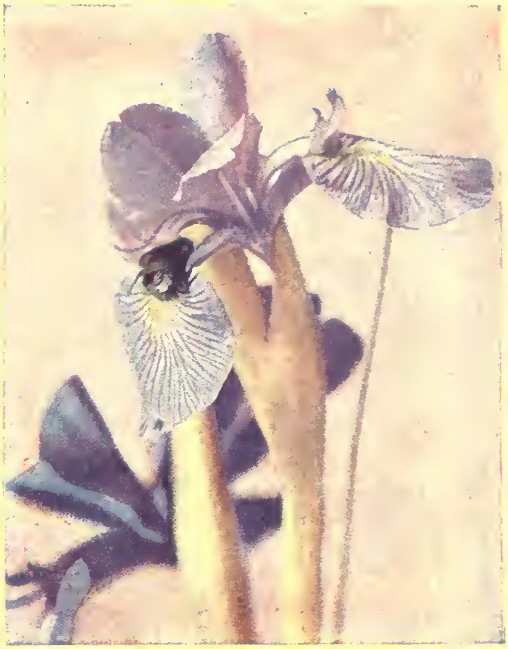

THE GREAT DEPTH OF THE CELLS IN WHICH THE BEES ARE BORN

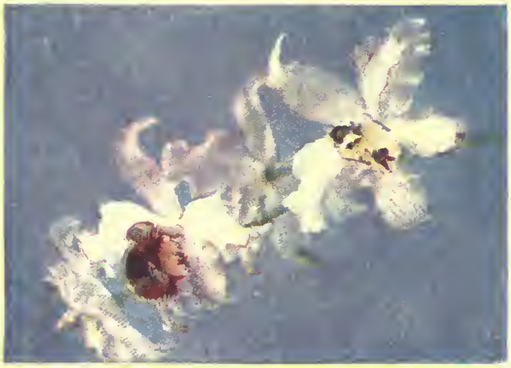
But perhaps the most wonderful thing about a beehive consists not in any custom or achievement of its inhabitants, but in the bodily structure of the worker bee herself The fact that she accomplishes so many great works and overcomes so many difficulties seems less of a miracle when we watch her under the microscope, see how wonderfully she is made, and with what a sheaf of ingenious implements she is provided. She is, first of all, to be a honey-maker, and is therefore equipped with a tongue which can be used either as a sort of sponge to take up minute quantities of nectar, or as a tube which can be thrust into the finest apertures, and by which the most carefully hidden stores can be sucked up. For the conveyance of these sweets to the hives, she has within her body an elastic reservoir whose contents can be discharged through the mouth at will.

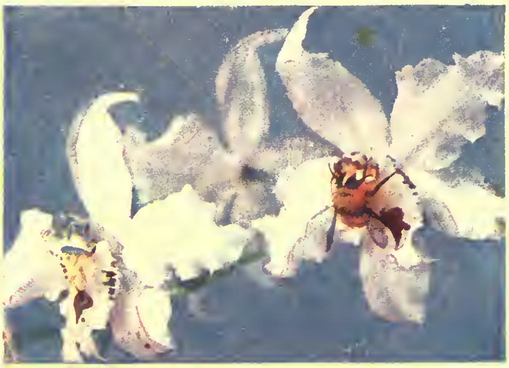
On the worker bee depends the maintenance of the supply of pollen, an indispensable ingredient of the food given to the young larvæ, to the stay-at-home queen, to the drones, and sometimes to the workers themselves. For the purpose of collecting this pollen, nearly the whole of the body of the bee is covered with curious branched hairs, like herring-bones, to which the grains of pollen adhere as the bee clambers into the flower, From these hairs

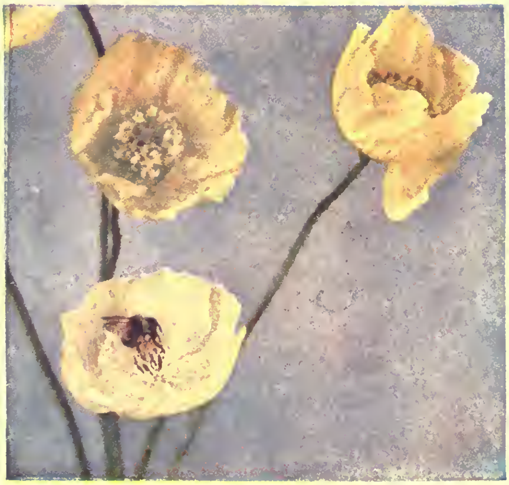
THE HONEY BEE CALLS UPON THE FLOWERS

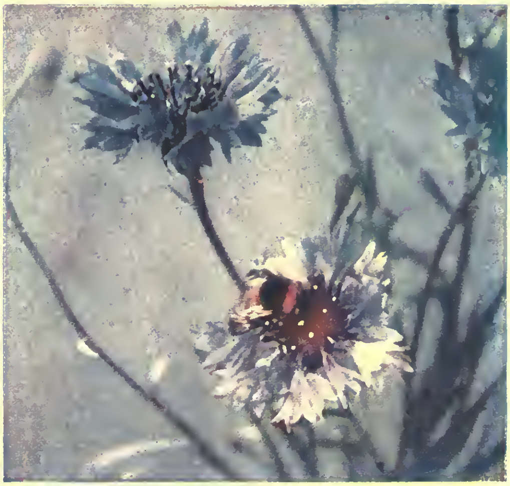
THE INVITING COLOURS OF THE IRIS


THE BEE VISITING THE IRIS FOR HONEY AND POLLEN


A BEE SEARCHING FOR HONEY IN AN ORCHID


THE BEE LEAVING THE ORCHID WITH POLLEN


A BEE COLLECTING HONEY FROM A YELLOW POPPY


THE BEE CALLS ON THE CORNFLOWER

the pollen is removed every moment or two by a process of grooming, which the bee carries out by means of a pair of beautifully constructed curry-combs carried on the hind legs. From these combs the pollen is again removed, and, after being kneaded together, is packed into baskets on the thighs, formed of stiff bristles. The pollen thus accumulated often makes a lump of immense size compared with that of its bearer, and the bees may be seen fairly staggering into the hive under the weight of their golden loads.

The provision of material for the comb, and its construction, is not less remarkable than the story of the cells. These have to be made of excessive thinness in order that as little space as possible may be taken up but they must be capable of bearing immense strains, and of resisting the high temperature of the hive. There is no natural substance affording all the qualities needed by the bee for her building work, so that she must create it for herself. This she does by means of her wax-pockets—six tiny crucibles lying under the hard plates of the lower part of her body. In these pockets are generated tiny oval scales looking like flakes of clear glass, and this is the raw material of the comb. The bee has two pairs of pincers, one on each of her hind legs, and with these she draws out the brittle scales from her wax-pockets, and proceeds to chew them up, mingling with the substance a strong acid secreted by certains glands in the jaws. Then, and only then, does the material we know as beeswax come into existence, and the worker immediately sets about the task of moulding it into comb.

WORKERS KILLING A DRONE AT THE END OF THE SUMMER
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But all this marvellous work of comb-building, with its exquisite regularity of form and accuracy of dimension, is carried on in what seems to us total darkness. How is it possible for the bees to construct it so perfectly, working in crowded companies together, the whole comb growing outward and downward in all directions at one and the same time? Here, again, we are faced with a question which the wit of man has failed to answer. A partial explanation may be found in the fact that the bee is provided with eyes which actually make light of what we regard as complete darkness, but this will not solve the difficulty. Vision alone, however perfect, could never guide the bee in all the tasks she performs within the hive. Probably we must believe that she has not only our own five senses, but other senses of which we can form little conception. An examination of her antennæ—the curious flail-like organs protruding from the middle of her forehead, which she incessantly uses in all her affairs—at once discloses evidence of this. On these antennæ we find no less than six distinct kinds of implements, all obviously organs of sense, and all perhaps conveying different impressions. We cannot be far wrong, therefore, in imagining that the bee has faculties, inconceivable in ourselves, which are necessary in her own special place in the scheme of life.

It would be easy to go on thus multiplying instances of the bee's amazing equipment for the work she does in the world. Many books have been filled with stories of this little friend of ours, perhaps the most interesting creature in the universe. But we must study the bee, not in books only, but in the hive itself, for though it is good to read of what other eyes have seen, it is better to see for ourselves.

The wonder of the bee is like the beauty of the lily of the field, the song of the bird in the hedgerow, the glory of the sunset sky; it is one more expression of the infinite mind of God, uttered for each heart alone. We must consider the lilies, how they grow; and we must consider the bees, how they live, if we would come to know this fellow-creature and to understand something of its wonderful work in the world.

THE CATHEDRAL AISLE OF THE TREES

INSECTS THAT SEEM TO KNOW

THE LITTLE CREATURES THAT AWAKE ANNUALLY FROM THEIR WINTER REST, AND PLAY THEIR PART IN THE WORLD

THE WONDER THAT FLIES PAST US ON A SUMMER EVENING

Have you ever thought, when you have watched an insect creep along a flower, or leap into the air, or disappear into the earth, that you are watching a mystery which no man who ever lived has yet been able to understand? This little insect, which you can crush out of existence with your finger, is more wonderful than the stars.

Those who tell us that this world came about by chance have many things to learn; they have, indeed, yet to begin to learn. There is no nonsense so great as theirs, no ignorance so colossal as that which would have us believe that life is a sort of accident. Ten minutes in the life of a lacewing fly shatters folly like this for ever. Let us turn over a few pages of "Insect Biographies," a plain book of insect stories and pictures, written by J. J. Ward, an expert photographer of animal life. It proves no theory, it has no arguments about the making of the world, but its plain stories and pictures of the lives of a dozen little creatures are more weighty than all the clever notions that men spin out of their heads. If the world had come about by chance this book would be impossible.

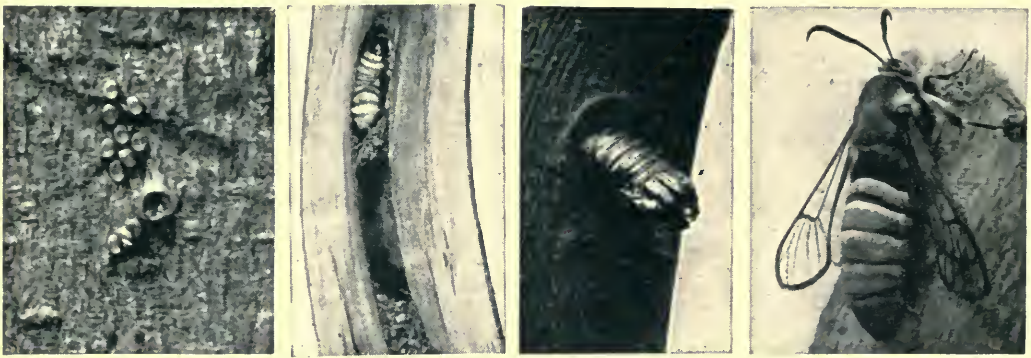
Sitting in the twilight of some summer evening, we have watched the winged procession of those lacewing flies that have been called the loveliest insects in their order. Its body is a pale emerald-green; its lace-like, silvery wings are iridescent with lovely hues; its eyes are veritable living jewels, sparkling one moment like burnished gold, the next moment like rubies of deepest crimson.

We look up at it for a moment; we say to ourselves, "What a beautiful thing!" and it is gone. But there has flown past us in that moment a wonder that no man knows. That little lacewing fly will presently settle on a leaf, will press against it, and eject from its body a drop of sticky fluid. The drop of fluid rests upon the leaf, and out of it this little mother draws a thread almost too small and fine for us to see. The thread hardens in the air, and at the end of it, hanging in space, this little mother lays an egg. We go about our business, and the earth spins round seven times, and then out of the egg at the end of the thread creeps a living thing. It creeps along the thread towards the leaf, and on the leaf is a giant—a creature twice as big as itself, an evil thing that eats up the life of roses and destroys our gardens. But the little stranger is not afraid. It has just come into the world and has never met a living thing before, but it grips this destroyer of roses, wrestles with it, crushes it, and in less than half an hour throws on one side the empty, shrunken skin of its first victim.

We need not claim this larva as a conqueror, nor attribute to it any virtue; it is enough to see what happens. Its first green-fly gives it an appetite for more, and it creeps about destroying them until, by the time it is ten days old, it gobbles up thirty in an hour, and by the time it is twelve days old it will eat a green-fly every minute. It is a cannibal, for it will suck the eggs of other lacewing flies—a fact which Mr. Ward thinks may explain why the mother lays her eggs at the end of a thread. Perhaps the little mother knows that her children will eat the eggs upon the leaf but will not climb the thread. That is a difficult journey, the first journey of a lacewing larva in the world, and it goes that way only once.

At twelve days old the larva draws itself up like a ball on the edge of a leaf, spins something very much like a piece of delicate silk, and wraps itself up from the cold. In an hour or two it has changed into a round cocoon, like a pea, and on the edge of the leaf it lies still for sixteen days. Then, from within, the little ball is opened, a round lid lifting, and—out comes a lacewing fly.

"It is surprising," Mr. Ward tells us, "how so large an insect can develop in so small a cocoon, but immediately it appears upon the surface of the leaf its wings begin to shake out their folds, and a few minutes later we see the insect developing in all its charming hues. Its bright green body, its gauzy and iridescent wings, and its sparkling eyes—together with its abominable characteristic of producing a most vile odour—have all been acquired in some mysterious way during the sixteen days while it was crushed within its little cocoon upon the leaf. How the magic was performed is a secret hidden deep within the pages of Nature's book."


The eggs of the hornet moth The caterpillar's tunnel The chrysalis crawls out The hornet moth lays her eggs

THE STORY OF A HOUSE IN A TREE AND ITS STRANGE INHABITANT

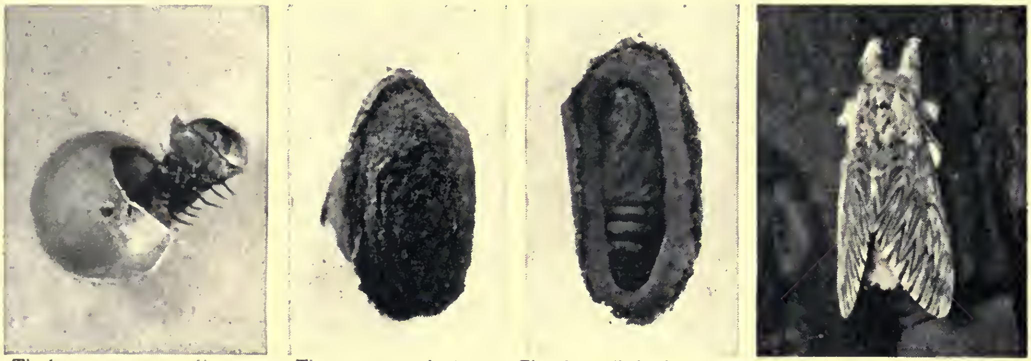
It has taken five weeks to make this tiny creature: seven days in the egg, twelve days—twelve creeping, killing days—as larva, and sixteen days in the cocoon, where something happened which all the wisdom of the world has not been able to explain.

1. THE GREEN-FLY CREEPS PAST THE EGGS ALL UNSUSPECTING

2. THE GRUB FROM THE EGG ATTACKS THE FLY

3. AND DEVOURS HIM WITHOUT PITY

That is the tale of the lacewing fly. How many hours of summer days we have sat watching that other little fly, which fixes itself in a point in space and beats its wings so fast that it seems to be perfectly still, until suddenly it darts to another point not far away and rests there, seemingly still again, except that we know it has nothing to rest on, and is holding itself up by the marvellous beating of its wings. It is the hover-fly, one of the wonderful little beauties that make a garden in summer a marvellous place to be in. Out of the egg of the hover-fly mother creeps a tiny grub, as long as the sixteenth part of an inch, and with neither eyes to see nor legs to walk. Yet this blind and crippled thing has a strength that we can hardly believe. It travels down a stem, and by chance a green-fly touches it. It cannot see, it has had no experience of the world, it has hardly begun to feel what it is to be alive; yet this tiny grub pounces on its prey, racing after it by means of the rough edges of its skin; and in this book is a photograph of this very thing as it happens, magnified so that we can see it more clearly than if we were standing by. This is what the photographer saw when he took his picture, Instantly the grub thrust its head forward, and a moment later it was standing upright on the tail-end of its body with the green-fly elevated in the air. In this attitude the little grub held the green-fly for over an hour while it sucked its juices, and this in spite of the fact that its victim was much larger than itself, and continually struggling to escape. It then cast away the empty skin of the green-fly and rested for a while. During the first day of its existence it captured and ate two half-grown green-flies and two smaller ones, and day by day, for ten days, its appetite increased in an astonishing manner.

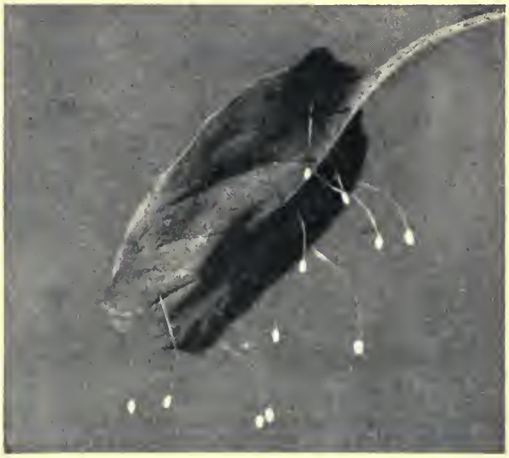


The larva creeps out of its egg The cocoon on the tree The chrysalis in the cocoon The moth ready to fly

THREE CHAPTERS IN THE LIFE OF THE PUSS MOTH

Ten days passed away, ten days of hard feeding, and then this grub hangs to a leaf and stays there another ten days. Its skin is hardening as it hangs, and at last breaks, and out of it, shining in black and yellow bands, comes a little hover-fly.

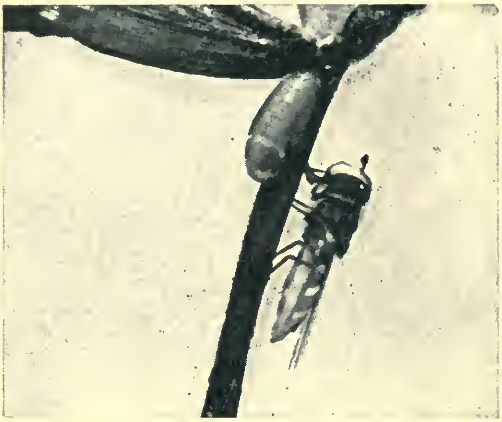
THE BEAUTIFUL LACEWING FLY



HOW THE LACEWING FLY LAYS ITS EGGS

One more peep at the wonder of insect life we may take from Mr. Ward's enthralling pages. We will take the hornet-moth, laying her little brown eggs on the bark of a tree. One day the caterpillar creeps out of the egg, exactly as we see another caterpillar doing in the picture on this page, and, instead of setting out in search of green-flies, this little creature begins to burrow into the trunk of the tree, boring its way until it reaches the centre, where it eats out a tunnel along the trunk several inches long, and widening as it lengthens. It has found its home. Here it grows, and lives perhaps two years, never leaving its dark and narrow house, but taking care to guard itself against invaders by blocking the end of the tunnel with wood-scrapings held together by silk-like threads, spun by the caterpillar and woven with the wood to make a barrier. Thus guarded, the larva lives until it is full grown, and then, as if it were making up its mind, it turns round and faces its front door! It is as if this strange thing knew what was about to happen; and perhaps it does, for now that it has turned round it moults its skin and becomes a chrysalis. *Had it not turned before, it could not do so now,* for in its new coat, hard and brown, it could not possibly turn round in such a narrow space.

With its head toward the entrance of its tunnel, the chrysalis lies for perhaps four weeks. And what happens then we may let Mr. Ward himself tell us. He is looking at the little hole in the bark of the tree, a neatly drilled hole just big enough to take an ordinary lead pencil.



THE HOVER-FLY AND ITS BROKEN CHRYSALIS

> The sun's rays are falling directly into the hole, partly illuminating its interior, and while we are wondering what function the hole could serve we suddenly become aware of the fact that there is something moving inside it. What can it be? Some inquisitive insect, maybe, that has entered and is now returning.
>
> Presently the forepart of a shiny brown body appears, gradually advancing by little bunts as if pushed from behind, until at last it is distinctly protruding from the hole. Still it continues to advance, and just when we expect to see the curious object fall on the ground an extraordinary transformation scene takes place.
>
> The brown skin suddenly breaks open, and from it a wasp-like insect with a black-and-yellow-banded body crawls on to the bark. Its wings at first look soiled and crumpled, but in a few minutes they unfold from their creases, and the insect at once begins to travel up the branch, continuing until it reaches the cut end left by the woodman. There the hornet-like creature suns itself for an hour or more, looking decidedly dangerous even as it rests. When the sun is at its brightest the insect's feelers quiver excitedly, and then, with a bee-like buzz, it takes to its wings.

That is not half the wonder of the hornet-moth, but then not half the wonder of anything in Nature has yet been told.

Mr. Ward, in this book, tells us merely that these things happen, and tells us all the more impressively because he describes simply the marvellous movements by which Life brings about her end. There is no sign of God, it may be said, in these strange things. But God is in the purpose of the world, and the purpose of hover-flies and lacewing flies, and a host of insects such as these, is to keep the balance of life in the world so that we may live.

Hidden away in our gardens now, lying still and knowing nothing, is a vast army of creatures that no man can number. Through all these wonderful months it has lain there, in silence and darkness, while the great world has gone by and men and women and nations have lived their lives. And soon, in this dawning summer, early in June, this army will burst out into the sun. It is made up of the countless myriads of hover-flies from last year's cocoons, the last brood of larvæ last year, too late to come to their full life then before the winter came, and kept in suspense until now.

This great army of little soldiers is one of the beneficent forces of the world. It finds, already waiting for it, a host of green-flies which, if there were no conquering host to pounce upon it, would, in a short time, make life impossible for you and me and all other living things. In its few short weeks of life one single green-fly may bring six thousand million other green-flies into life, and it was Mr. Huxley, who did not exaggerate these things, who calculated that the descendants of one green-fly, if unchecked for only ten generations—that is to say, throughout one summer—would produce a bulk of matter equal in weight to all the living people on the earth.

Well, the lacewing flies and the hover-flies will be waking soon, and the green-fly may look out. We shall go on our way, and most of us will think nothing about it; but, whether we know it or not, we may rest and be thankful, and sleep comfortably in our beds, knowing that Life will not fail us, but that her myriad hosts will maintain the balance upon which you and I and all things living unceasingly depend.

FROZEN IN HER CASTLE
These photographs are from Mr. J. J. Ward's "Insect Biographies."

NEDDY OF ANYWHERE

THE LONG STORY OF THE DONKEY AND HOW HE CAME TO BE THE CHILDREN'S FRIEND

THE SPLENDID SLAVE OF MAN SNATCHED FROM THE WILDS

Of all animals, the donkey is perhaps the most misunderstood and underrated—in Europe and America. We represent him as the embodiment of all that is stupid, stubborn, and ridiculous. We call a dull boy or a foolish man a donkey.

It is all very unfair. The donkey is naturally a clever, courageous animal; all these other unintelligent qualities are not found in its wild state. The wild ass, from which our common domesticated donkeys are descended, is a beautiful creature, fleet of foot, graceful of carriage, splendidly devoted to its young, and clever and valiant in their defence against the attacks of lions, leopards, wolves, and other ferocious beasts of prey. Few people, seeing animals of this type, guess that these fine creatures are related to the poor drudges which draw overladen carts in England. But all donkeys belong to the same stock; the beautiful creatures which defend themselves and their foals against the onslaught of the great flesh-eating animals, and the pitiful little donkeys, or burros, which are abused and worried into stubbornness and savagery in Mexico, have the same ancestry.

The differences between the two, however, are very marked. The wild kind are the descendants of asses which have never known the gall of captivity and slavery; the domesticated kind are the offspring of others like themselves, which have for thousands of years been the victims of a climate for which they are not naturally fitted, and of a system of ill-usage which would ruin the temper and manners of any animal.

But we must be careful about this matter of ancestry, for some day some of us may be travelling in the wilds of Asia and have the good fortune to see the beautiful wild asses which range the highlands of Tibet, seeking their living 16,000 feet above sea-level in summer, and descending only slightly lower to the valleys in winter. Our domestic donkeys are not related to these, except in the way that our cats are related to the lions and tigers. All donkeys, horses, and zebras sprang originally from the same type of ancestors, but our domestic donkeys were snatched from freedom from warmer lands than the Asian highlands know. They came to us from Arabia and Syria, hot, burning lands with sparse vegetation and abounding in rocky and perilous wastes, where only the nimble feet of asses and donkeys could carry men about.

From the tropical heat of Africa and Asia, the donkey has been taken to the colder latitudes of the North, and the result is that it has grown smaller, stumpier, and more hairy than its sleek and agile cousin which still haunts the boundless wilds. The domestic donkey is, then, really an exotic, hardened by long ages of residence in foreign lands into a Northern representative of the swift denizens of the desert and the scorching rocky places of which we read in the Bible. The tiny English donkey, reared in a stuffy stable, amid cold and draughts, upon poor food, and put too early to work, is like the sickly, puny child of the slums—a weed.

There is a sort of superstition that donkeys never die. We suggest that such and such a miracle will happen "when you see a dead donkey." This suggests that donkeys can tolerate all sorts of conditions and thrive in spite of the greatest hardships. The truth is that the donkey is not, by nature, as hardy as the horse. It is not as hardy as man. Man can go to any quarter of the globe, and the horse and dog can go with him. The donkey cannot. It cannot stand the same degree of cold as the horse. But for this Sir Ernest Shackleton and Captain Scott might have taken big, sure-footed donkeys with them on their South Pole expeditions. They took ponies instead. There are limits of climate beyond which the domestic donkey cannot pass. The wild donkeys of Tibet and Mongolia, where the cold is excessively severe, have not been domesticated, so there is really very little opportunity of testing them. We have tamed only the Arabian, Syrian, and African types. These were the first donkeys to be pressed into human service, and their descendants have continued ever since in bondage.

THE ROAD FROM BETHLEHEM. From the Painting by Edward Stott, A.R.A.

How long this period of servitude has lasted we cannot tell; but it began in ancient days, as we know from the Bible, and from ancient sculptures and paintings. But the taming of donkeys has proceeded on different lines in different lands. In the East the ass is more highly regarded than in the British Isles. In Persia and other warm countries donkeys are tall and sleek and swift of pace where climate and conditions are favourable for them. Because donkeys have not naturally prospered in Europe, they have been regarded there as the poor man's horse.

Poor men are not naturally less kind than rich men, but they are less able to buy good food for their animals, less able to stable them properly, and the result has been a continuous decline in the English donkey. Its work has been hard, its treatment bad. Often it has been shamefully ill-used, with the result that its high spirit has been sapped, and only the sullen will of the unconquerable little beast has remained. The sullen, savage donkeys of one generation have become the parents of the donkeys of the next generation, and these have, of course, inherited the qualities of their parents, so that they show a progressive scale of stubbornness and temper, with no hope of developing what we may call the higher qualities of donkey nature. They have done well with the horse and dog, and have set the whole world an example, but the average English donkey is a disgrace. Notice the donkeys at the seaside. They are for the most part in charge of thoughtless boys, who permit them to be shamefully loaded, and beat them cruelly to make them run under burdens they ought never to carry. Note also the miserable conditions under which most town donkeys live—scanty food, wretched stable, long hours of hard work in all sorts of weather. If we note these conditions, and imagine their having persisted from early times, we understand how it is that stubbornness, perhaps with a certain measure of defiant ill-will towards their masters, marks these donkeys. And yet, whatever men may say, behind all the seeming stupidity of the donkey there is great intelligence in that big, heavy head of his.

COMING THROUGH THE GATES OF SAMARIA

Donkeys are much used in England, and four types of persons understand and appreciate them—kind-hearted London costermongers, ladies who live in the country, children with donkeys as pets, and naturalists. Some of the donkeys owned by costermongers are beautiful little creatures, well fed and well groomed, which trot nimbly along, drawing quite big loads, clever as cats in slippery places, gay and eager all day at their work, and affectionate as pet dogs to their masters. Old ladies in the country who use donkeys for their little carriages know what excellent qualities these animals have, but they exercise care in the choice of their animals. They buy a donkey which has a good record, and is known to be sweet-tempered, unspoilt by brutality and want—a donkey which has not only been kindly treated itself, but probably comes from a line of ancestors which have been very well treated.

Such a donkey proves as docile and affectionate as the nicest pony, although it must be frankly admitted that one which has been ill-used, or has had parents which have been ill-used, may be really vicious and dangerous with both teeth and hoofs. The writer has good reason to remember how docile an old lady's donkey may be, for the docility of one of the race gave him the first thrilling adventure of his life. There was a charming old lady who had a dear little donkey, which would follow her about like a dog, which knew all the places whither it was driven by her, and knew its way to its stable as well as we know our way to bed. To the writer, when a tiny boy, it seemed the grandest thing in the world to sit up in the little trap and be drawn about by this handsome donkey, and one day he was allowed to drive the donkey back to the stable. Now, the donkey knew full well the place to which he had to go; he could have been there in two minutes.

But the little boy did not understand anything about driving. He had the reins in his hand, but he had no idea that the donkey was guided by them. He thought there was some secret understanding between the animal and its driver, and that the reins were simply a part of the driver's costume. So when it came to the turn of the road down which the donkey should have been guided, the boy held the reins limply, and saw, to his horror, that the donkey was going on past the end of the road. The donkey walked very slowly, and turned its head to glance down the highway along which it ought to have gone, but it was far too well behaved to go that way unless bidden by a pull on the rein. Its dinner lay to the right, but because it was being driven it went obediently straight on, leaving a nice mangerful of bran and oats and chaff to take care of itself. But this placed the boy in what seemed a terrible position. He did not know how to get the obedient donkey home, and was slowly carried along the great main road, crying bitterly at his awful plight.

THE DONKEY'S BURDEN

Luckily, a rescuer appeared in sight. An errand-boy from an ironmonger's shop was marching along the road, carrying a big zinc bath on his head. He did not look at all the sort of boy to be frightened by donkeys, so the little fellow in the trap called out: "Oh, please save me! The donkey is running away with me!" The boy with the bath on his head walked into the road, stood before the donkey, saying, "Shoo! Go home!" and banged the bath on the animal's head. The donkey stopped, thought for a moment, then slowly turned round and went straight home. It seemed in that moment of reflection to have realised that its little friend in the trap, who was supposed to be driving, was, after all, a great booby, and that it must act for itself.

The boy with the bath on his head stood laughing as the trap went slowly away, but he would not have laughed so jeeringly had

THE CHILDREN'S FRIEND ALL OVER THE WORLD

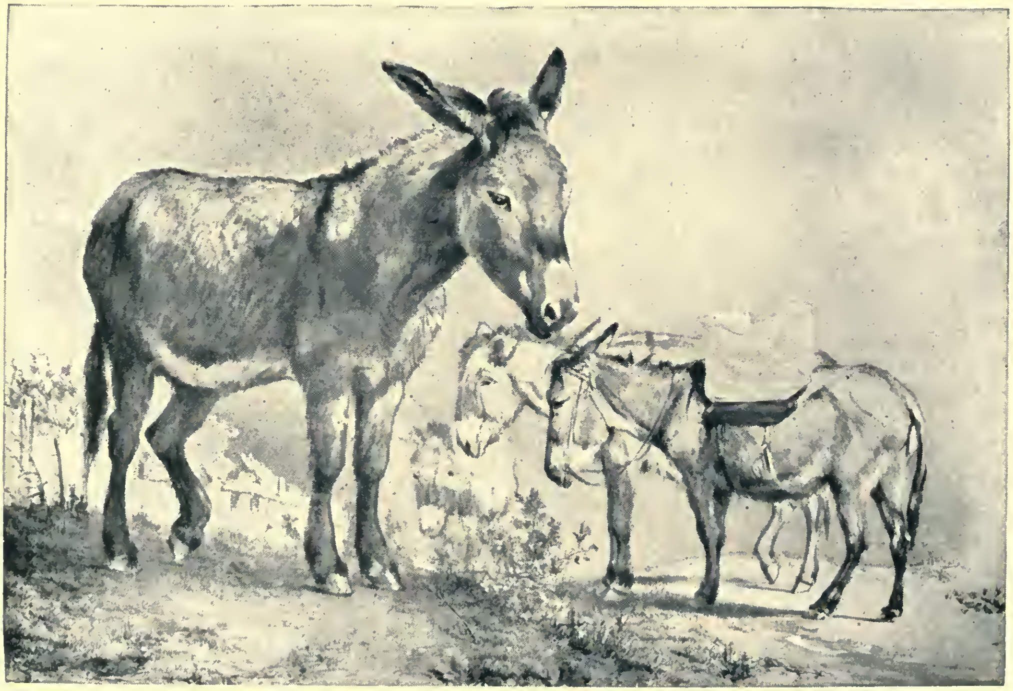
BLACK AND WHITE

WHITE AND BLACK

he known that to the boy in the trap he, with the zinc bath like a giant shield over him, seemed a true knight in shining armour sent out to rescue children carried along perilous highways by unguided donkeys into the Never-Never Land.

That is an example, not of stupidity on the part of the donkey, but of gentle docility. Although knowing its way home perfectly, it bowed its will, as it thought, to that of the little child in the trap, who was supposed to govern its actions. Many examples could be given of a different and higher power of reasoning in the donkey. Children who have well-behaved donkeys know how clever they are, what funny tricks they have, how clearly they seem to reason. Here is a case in point. A farmer had a number of horses which, during the week, were kept in their stables, rest in the fields being reserved for the week-ends.

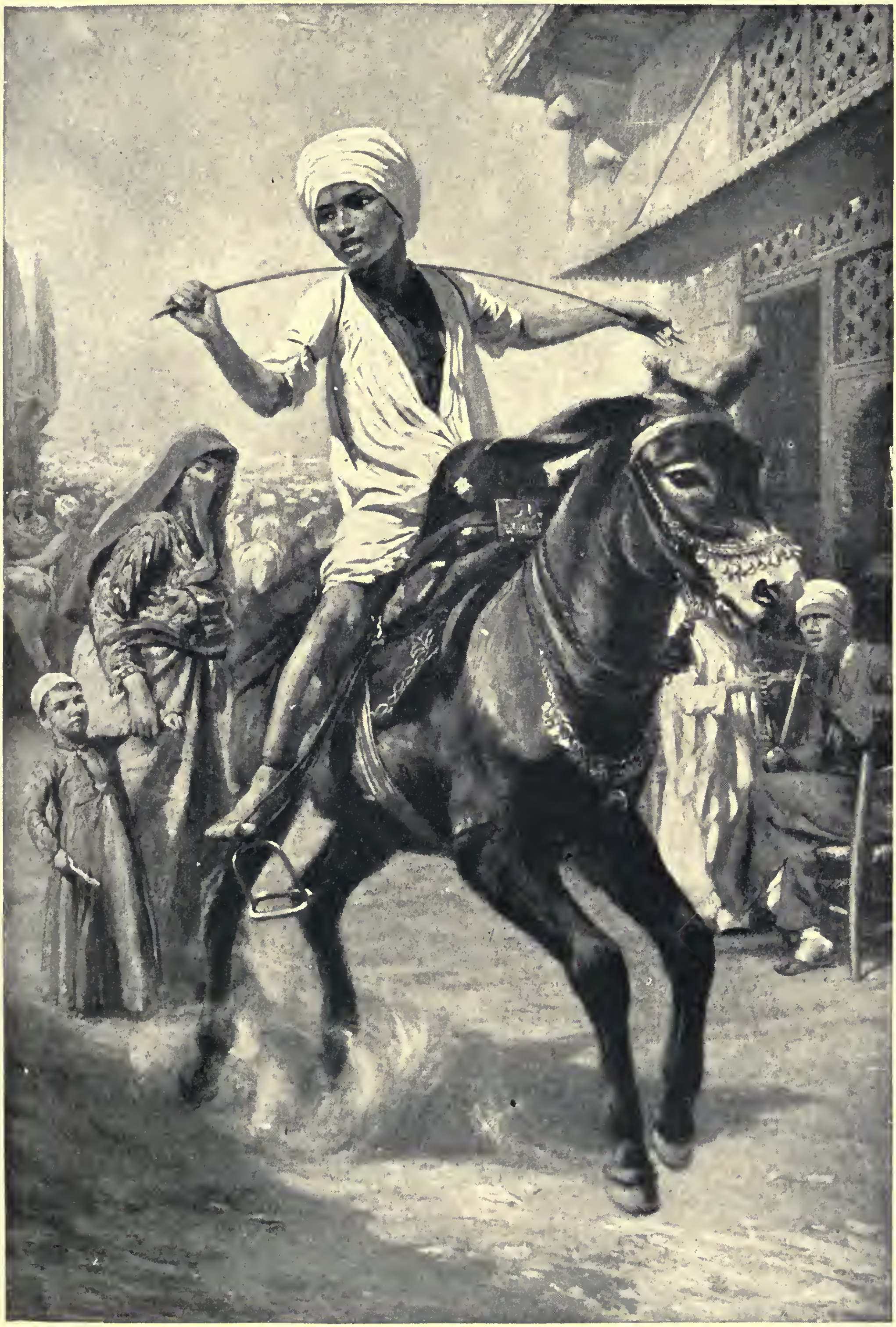
He had also an old favourite, the children's donkey, who was allowed to roam in a paddock leading to the fold-yard in which the stables were built. In the stable were many stalls, but all the horses entered and came out by one door. This door was bolted on the outside, and the bolt was well beyond the reach of the horses within. Yet, to his surprise, one day the farmer found that some of the horses had got out of the stable, and were wandering about in the paddock. The door had been safely bolted, and there was no explanation of how it came to be opened. Again and again this happened, and nobody could find out how the horses were set free. The farmer concluded that some spiteful person was playing tricks to annoy him, and after the men had stabled the horses and gone their way he hid himself and watched. He soon discovered the meaning of the mystery. Ned, the donkey, browsing about in the paddock, walked quietly into the fold-yard and up to the stable door. Gripping the bolt with his lips, he got the head of it between his teeth and drew it back. The door at once opened, and out came the horses, neighing and squealing with delight at being set free!



A STUDY IN DONKEYS—BY THE FAMOUS ANIMAL ARTIST, THOMAS SIDNEY COOPER, R.A.

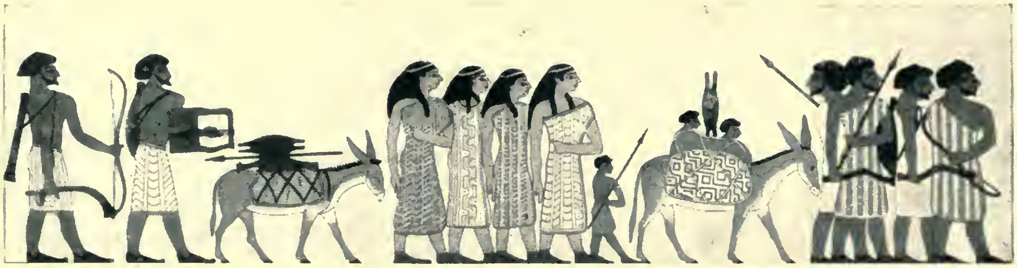
We hear a lot of nonsense about so-called "thinking horses," which are supposed to do sums and spell words, but there is little truth in these stories; consciously or unconsciously their masters and trainers make signals to which the horses respond. But the feat of this donkey was much more remarkable than the tricks of any trained horses, for Ned was untrained; he had thought out the trick for himself. Perhaps he had first rubbed his nose against the bolt and accidentally pushed it back, so freeing the horses, whose company he liked. Such a thing may have

THE ARAB BOY RIDES OUT ON HIS STEED

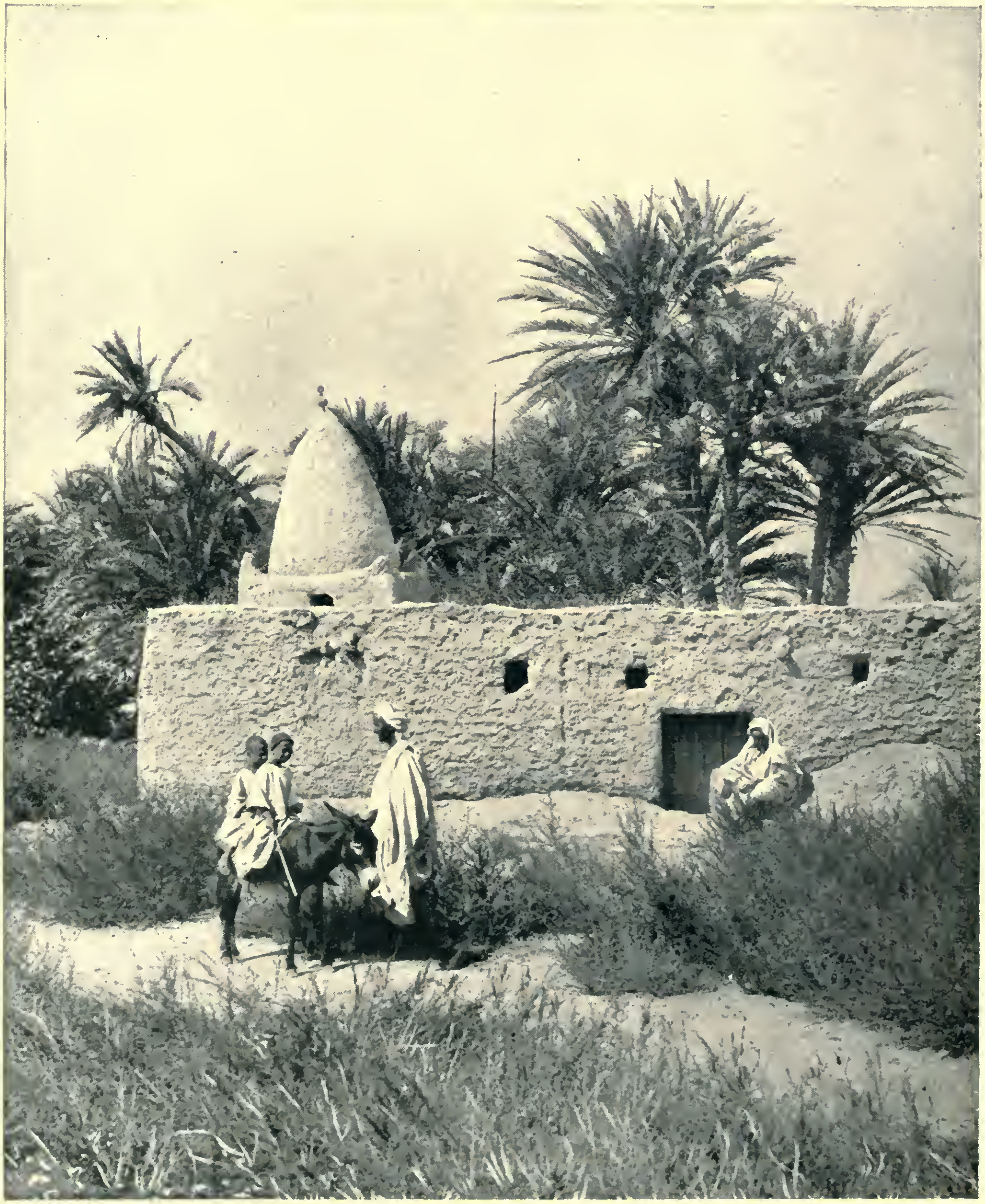


THE PATIENT MULE, THE FRIEND OF MAN IN THE DESERT AND THE MOUNTAIN. By W C. Horsley

MAN'S COMPANION THROUGH THE AGES



THE DONKEY IN EGYPT IN THE DAYS OF PHARAOH—A PICTURE THOUSANDS OF YEARS OLD



THE DONKEY IN EGYPT NOW—CARRYING THE CHILDREN OF A MUD-WALLED VILLAGE ON THE NILE

THE PATIENT FRIEND WHO BEARS OUR BURDENS

DONKEYS CARRYING HAY IN EGYPT

HOW THE DONKEY GOES TO CHURCH — A LOAD OF GREEN LEAVES FOR A CHURCH AT SEVILLE, IN SPAIN happened a second or even a third time, and by then the donkey would have learned to connect cause with effect. Animals do so more readily than we generally suppose.

The attendant who has wild asses in his care at a zoo would tell us, if we asked him, that while the foals of wild asses are gentle, clever, lovable little creatures, when they grow old they are treacherous, savage, and dangerous. That gives the wild donkey a very bad name, but the truth is that the wild ass, when it grows up, yearns instinctively for freedom, and is sullen and savage and ready to attack its keeper, not because it is senselessly fierce, but because it seeks to gain its liberty. The sweet little squirrel, which is absolutely harmless under ordinary circumstances, will inflict a terrible bite upon the hand which roughly grasps it—not because it is a savage animal, but because in its terror it seeks to bite itself free from restraint, as it would bite at a piece of timber which held it prisoner in a tree.

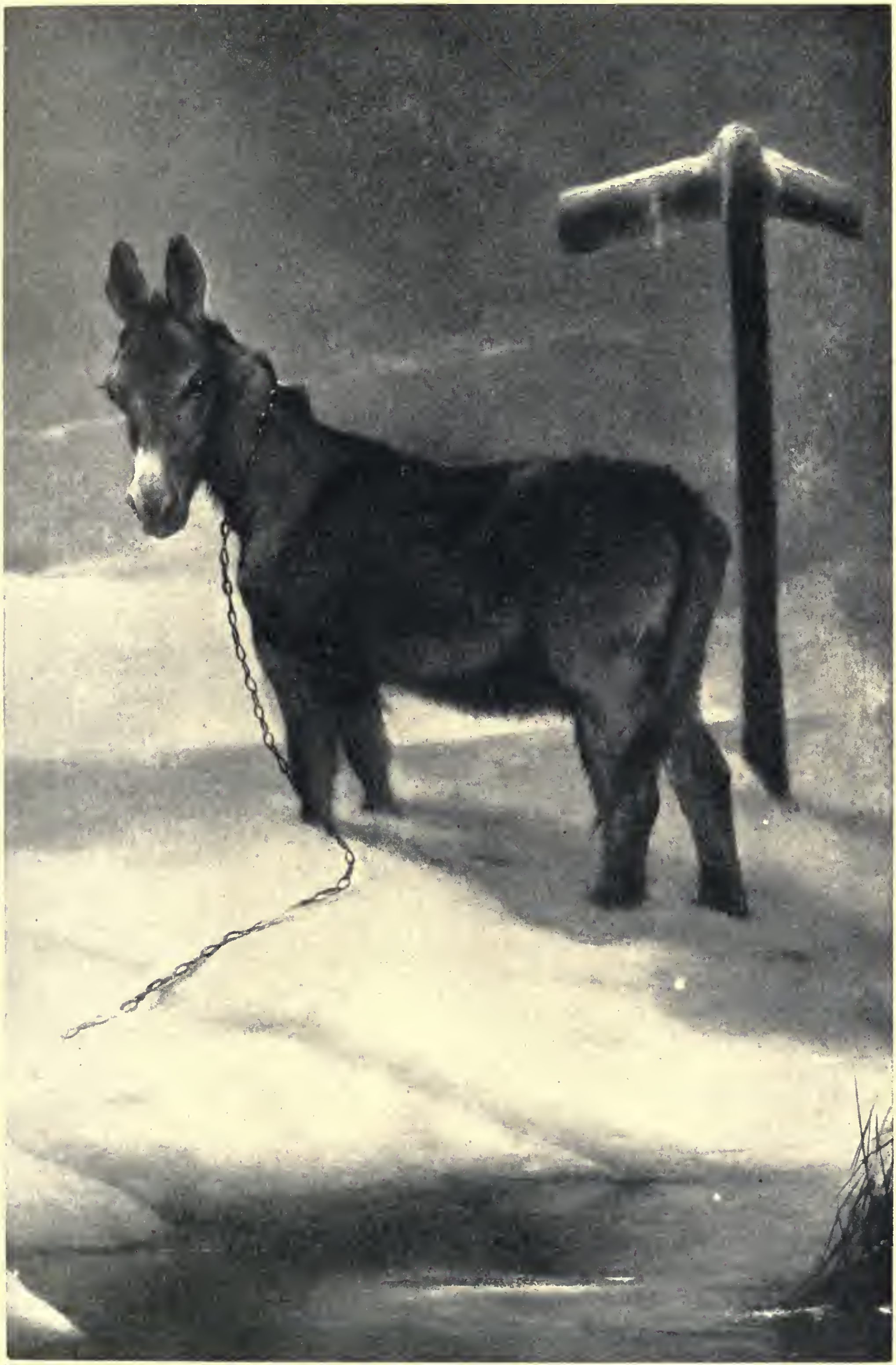
The man who keeps these animals in confinement regards any creature as detestable which does not do exactly as he desires, which lets natural impulses outweigh recognition of the kind manner in which he *keeps it prisoner.* He does not look at the case from the donkey's point of view. We must not, then, condemn all donkeys, and say that, because captive wild creatures are morose and capricious, therefore it is the nature of all donkeys to be morose and capricious

OLD FRIENDS

The pictures on pages 248 and 253 are reproduced by courtesy of the artists; this picture and the photographs on pages 255 and 258 are by H. W. Nicholls.

Other instincts besides a passion for freedom are preserved in the donkey, and its ability to secure footing in rocky, slippery places, and to exist upon food impossible to most other herb-eating animals, are among the number. There is nothing in the formation of a donkey's hoof to suggest that it is more sure-footed than the horse, but such is the case. It can scramble among rocks and treacherous ways where it would be fatal to take a horse. The horse is a native of the plains; the wild ass delights in stony and rocky places. It leaps and bounds with considerable speed among rocks and precipitous ways where the fleetest of horses cannot follow it. The domestic donkey reveals the ancient skill of its family by the manner in which it creeps with heavy burdens along precipices and dangerous paths where only itself, or its relative, the mule,

THE DUMB AND PATIENT FRIEND OF MAN



WAITING FOR SUMMER TO COME AGAIN—THE LONELY LIFE OF A DONKEY IN WINTER

This picture is by Edwin Douglas, and is reproduced by permission of the Autotype Fine Art Company.

could go. "Only a donkey would be so stupid as to eat thistles" is sometimes said of the patient ass, but this habit is another reminder of the ancient habits of our little friend's ancestors in the wilds. Wild asses eat the prickly herbage which rocky desert places afford, thorny growths which would be impossible as food for other animals. Hence the fact that a donkey eats thistles is not an evidence of its folly, but a relic of the long-distant past in which its ancestors learned to make the best of a bad job, and to thrive and grow fleet and beautiful upon food which would make all animals but themselves starve and die.

Wild asses, when they are threatened by savage, wild animals, gather together in a tightly compacted group. The males gallantly keep upon the outside, with the mares and foals in the centre. Biting and kicking with all their strength, they valiantly oppose the brute which seeks to prey upon them. Even the tamed donkey has something of the same fighting spirit. The instinct is as alert and vigorous in the domestic donkey as in the wild.

Not long ago, as a little donkey was drawing a cart laden with coal in Liverpool, a huge bulldog flew at it and seized it by the nose. With a violent wrench the donkey threw off the dog, then, rising upon its hind legs, it struck out with its fore feet, throwing the dog some distance. Enraged by this treatment, the dog returned to the attack, but this time the donkey was ready for it, and, rearing, it struck out again with its hoofs. Again and again the dog, with the courage of its breed, returned to the attack,

NEDDY OF THE ISLE OF WIGHT—THE WELL-KNOWN CARISBROOKE DONKEY

THE DONKEY WHO WOULD NOT GO

but each time the donkey, although hampered by its cart, backed a little way, threw itself upon its hind legs, and hit out with all its force. At last it got the dog down and trampled upon it, as the dog deserved. The dog limped away, howling, and the brave little donkey went on with its load as though such a thing were an everyday event in its coal-hawking career. Probably it had never had such an experience before, yet some mysterious instinct had taught it instantly what to do; and it did just what its ancestors in the wilderness did ages ago when they were attacked by wolves.

Except in Mexico and in the mountainous regions of the West, where it is called a burro, the donkey has never been used on this continent as a beast of burden. It cannot live in the cold winters of the extreme north. Sometimes, however, well-cared-for donkeys may be seen in the parks of the United States, drawing carriages for the little ones. It is sometimes kept as a pet for children, and many stories are told of its sagacity. Some years ago, the children of the superintendent of a large company in a Michigan town had a pet donkey which roamed at will all round the place, except over the lawn and through the garden. But the grass on the lawn was soft and green, and the flowers and shrubs sweet and juicy, and Jenny looked longingly at them through the fence. Pretty soon she opened the gate, walked boldly in, and proceeded to regale herself. The superintendent laughed at her cleverness, and bought a new latch. That, too, she opened. Another was bought, and Jenny opened that also. This happened several times, and then the superintendent bought a curious, patent fastener, which he thought she would surely be unable to open. It puzzled her for a few days only. Then she discovered the trick, and one fine morning she was found calmly grazing on the well-kept lawn, to the delight and terror of the children—delight at her cleverness, and terror lest they should lose their pet. Finally, it was found that the only thing that would keep her off the forbidden grounds was the use of a lock and key.

To the Christian the donkey has very tender and solemn associations. It has had a warm place in the hearts of men since Jesus rode upon an ass into Jerusalem. Yet it is only in Eastern countries, where the Christian religion is mostly unknown or unheeded, that the donkey is treated with the esteem and affection which we bestow upon our horses and dogs. Given the same measure of kindness that these animals receive at our hands, the donkey would be just as lovable as the horse or the dog. Even as it is, with all his ill-usage and all the temper and stubbornness which ill-usage breeds in him, he is still one of the best of our four-footed friends.

THE MONARCHS OF THE JUNGLE AT WAR

The elephant and the tiger are both monarchs of the jungle, each in his own sphere, but when they meet there is a fierce battle, and till the fight is over none can say who will be the victor. More often than not, however, the elephant is conqueror, and the tiger is fortunate if he can steal away from his enemy into the depths of the forest.

A DAY IN AN ELEPHANT'S LIFE

Day and night are pretty much alike to the elephant in his wild state. In hot weather he takes longer rests during the day than during the night ; that is about the only difference. We will take a peep at him in the hot weather in his native Indian wilds. He gets on the move at about three o'clock in the morning.

Vegetation is heavy with dew, and he ambles through the jungle with some of his friends near. He has only tiny eyes, and his sight is not very good, but that marvellous trunk of his is a sort of third eye. With the trunk extended before him, he walks along, smelling and feeling his way, the trunk answering for him as the feelers, or antennæ, answer as guides to an insect.

There having been recent rains, the elephant has an ample choice of food. A tussock of grass attracts his attention, so he coils the end of his trunk round it, pulls it up, and pops it into his big mouth. Next minute he espies some tender leaves growing on a tree, and picks these off with his trunk as daintily as a young lady takes a bunch of grapes. Then he comes to some bamboos. Here is a regular feast. He likes not only the leaves but the young shoots as well, and he picks away as neatly as possible with the wonderful trunk, and if even a leaf falls he points down his trunk and picks it up.

On he goes again till he finds some wild fruit, and this he plucks and eats with great relish. Another tree offers bark which he likes, so he skilfully strips some of this off, tearing away at a part already broken. He is getting on very well to-day, but he is not satisfied, for it requires an enormous bulk of food to satisfy his great appetite.

Six or seven hours pass in this way, and the sun, which is becoming very hot indeed, warns the elephant that it is time to seek shelter. So he goes deeper into the shade of the forest, and places himself under the protection of a great tree. Vegetation closes him in on every hand. Hunters draw near. They stand within a few yards of the tree, but do not see the elephant. In peering through the high grass surrounding them they simply see a dark mass, but without a view of the head or tail there is no break of light to show them that they are looking at a live animal, and they pass away unsuspecting. If he had got scent of them, however, the elephant would either have shuffled away as fast as he could, or, had he been vexed at the disturbance, he would have charged at the men. The latter might run, but they cannot get away unless they dodge or are very lucky. The elephant, bulky as he is, can run faster in the jungle where he lives than any man. Roots and creepers do not stop him, but they do stop the man.

To-day, however, the hunter passes away unseen, and nothing comes of the meeting. The only thing that does annoy the elephant is a scent which the air carries to him. He puts out his trunk and sniffs, and says to himself in elephant language, "A tiger." So he beats angrily upon the ground with his trunk, and blows a little blast so that his comrades round about may know, and the tiger is only too glad to sneak away to safety beyond the reach of tusks and crushing feet.

Our elephant is well sheltered for a time where he is, but presently the sun steals between the leaves and scorches his back. He cannot endure this, so he plucks leaves and grass, and with these covers his back as with a thatch. That keeps him cool and prevents the flies from biting his tender skin. Leaning against his tree, he has a delightful snooze till about three. He does not lie down. Many elephants never lie down at all to sleep, but always stand.

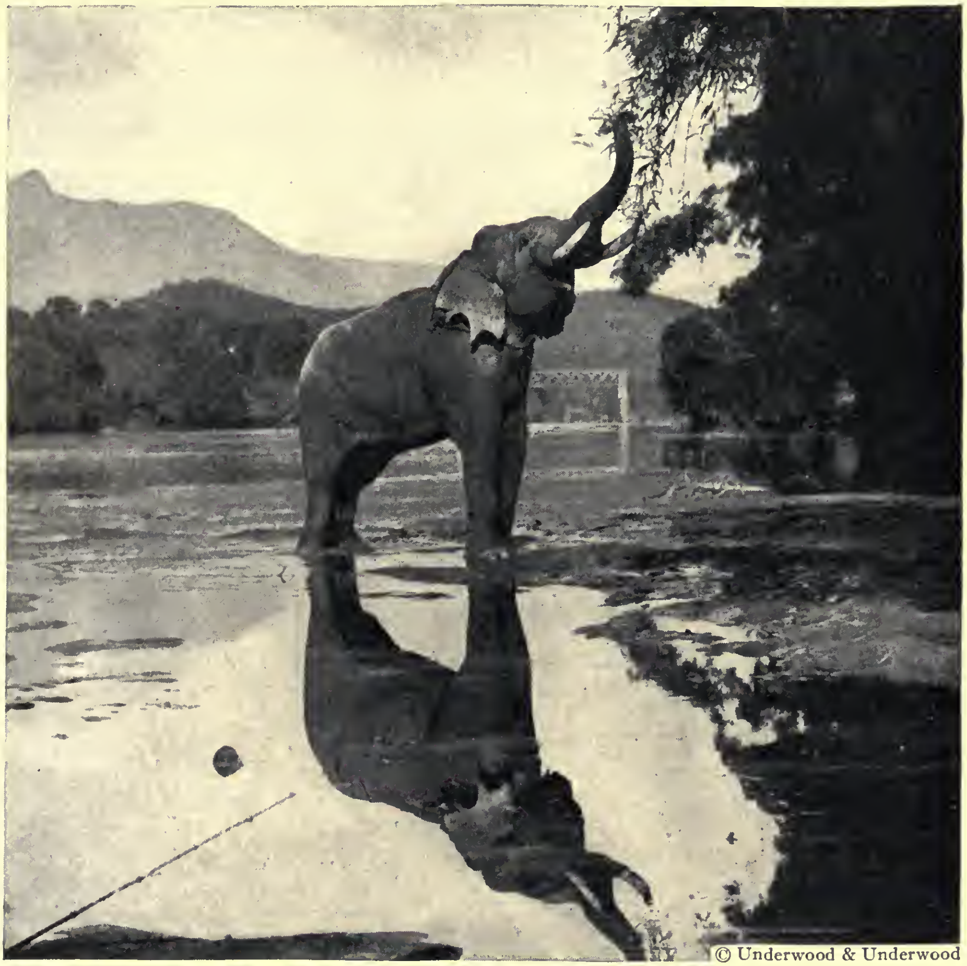
Three o'clock comes, and the elephant wakes up, and sets off to his favourite pool. As he goes he picks a bough of a tree, plucks off and throws away the side branches, and leaves a nice plume of leaves at the end. With the thick end of the branch in his trunk he walks daintily along, flicking himself with the fan that he has thus made. It is not to keep him cool, but to brush off the flies that worry him.

Arrived at the pool, he has a glorious drink. He lets down his trunk into the water, and draws up the cool fluid in it, then transfers the water to his mouth. That is his way of drinking. If one of us had the courage to offer him a bucket of corn he would treat the grain in the same way, drawing it up in his trunk, then blowing it into his mouth. But here it is only a question of water. Having drunk all that he needs, he sucks up more water in his trunk, then squirts it over his back and sides. How he does enjoy this bath !

AN INDIAN ELEPHANT IN THE JUNGLE WITH HER YOUNG

Still he is not satisfied, and presently he goes entirely down to revel in a good roll in the water. It is the happiest part of the day for him, but he is careful in choosing the time to take it ; he would never think of bathing after the sun has gone down, though, of course, he would drink. Even his thick hide must be

HOW THE ELEPHANT TAKES HIS MEALS



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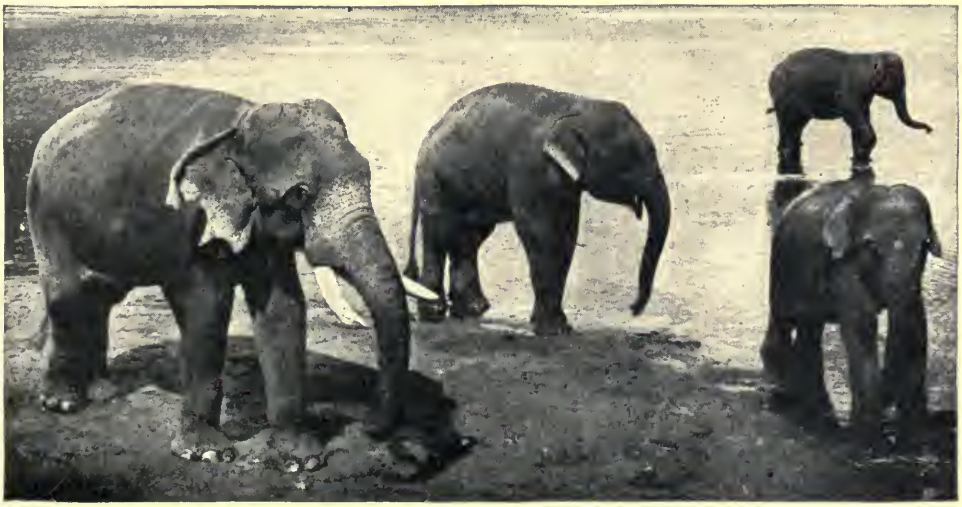
AN ELEPHANT AT HIS MEAL AMONG THE BAMBOOS OF CEYLON



ELEPHANTS BY A RIVERSIDE, WHERE THEY HAVE GONE TO DRINK

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guarded against the chill of an Indian night. If rain comes, well, that cannot be helped, but of his own choice he will not begin the night with the discomfort of a damp skin.

And now there follows the second part of the day's feeding. It is now four or five o'clock, and the elephant has got six or seven hours in which to wander after food. He has got a friend in the herd to which he belongs, who disappears mysteriously in the evenings, deserts the usual feeding-places, and comes back in the early morning. Our elephant knows where that other elephant has been ; he knows that he has been robbing the crops in cultivated grounds. Our elephant is too wise to go there. He remembers that his mother, when he was a little fellow, always refused to follow the big tusker who went off to the cultivated lands, and that while the big thief was shot when in the act of robbing, she escaped, and still leads the herd to-day when it requires a leader.

So our friend feeds along in the happy wilds, taking more grass and leaves and twigs and wild fruits.

Night settles in dark and cloudy, but it is not too dark for him ; he can find his way without difficulty, and with his keen scent and delicate touch he makes no mistake about choice of food. He does not carry a watch in his trunk, but he knows when it is about eleven o'clock, and then he settles down for another snooze. He dreams about his uncles and aunts who dwell among human habitations, and perform strange and wonderful tasks for men, living on terms of great affection with their masters. Perhaps some day our friend will do the same thing. Meanwhile, it is good to be free in these wilds abounding with plentiful food and sparkling water.

And should that tiger dare to show up again to-morrow, why, with tusks or feet, our friend will make him repent his boldness in venturing to break in upon the peace of an elephant's day.

A WILD ELEPHANT IN THE INDIAN JUNGLE BREAKING DOWN A TREF

THE ELEPHANT ENJOYS A BATH

THE ELEPHANT GOES INTO THE RIVER FOR A COOLING BATH

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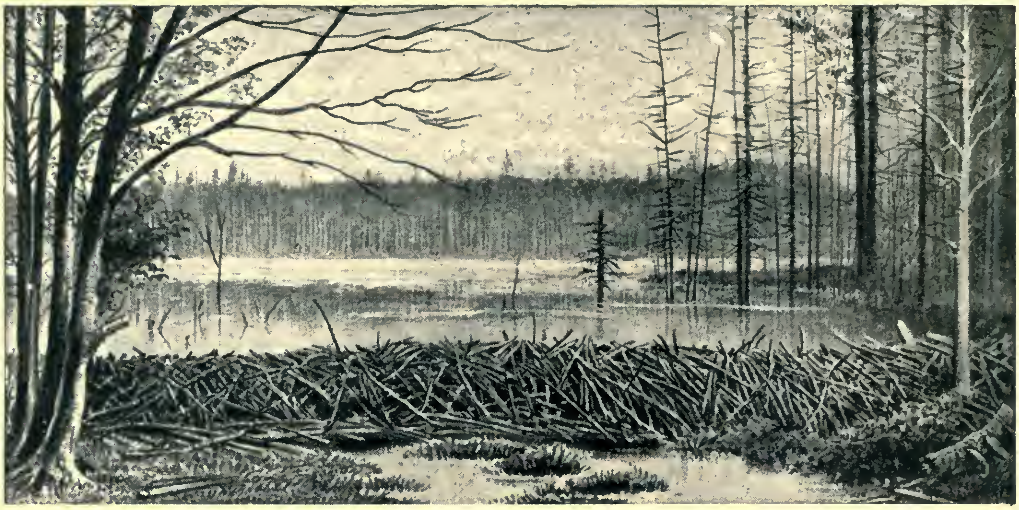
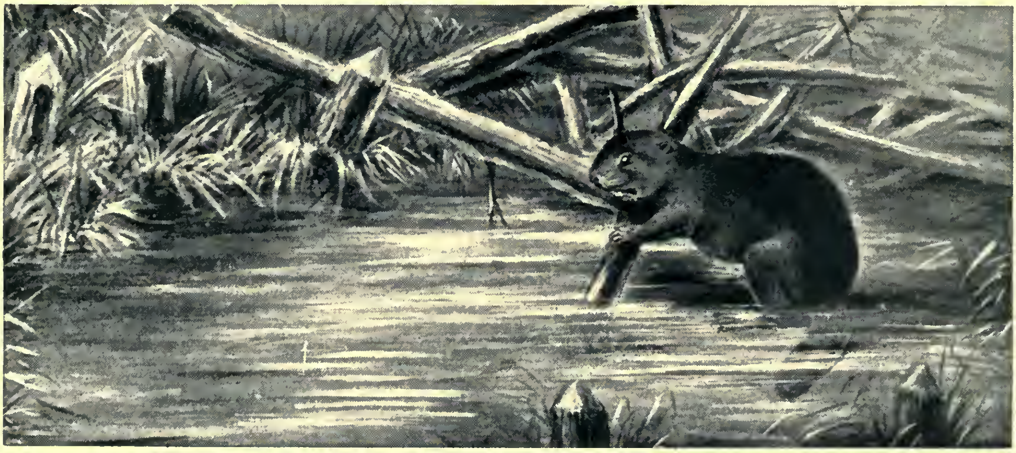
HE FILLS HIS TRUNK AND GIVES HIMSELF A SHOWER BATH

AFTER GETTING COOL HE LEAVES THE WATER FOR DRY LAND

HOW THE BEAVERS TURN A RIVER AWAY



AN EMBANKMENT MADE BY BEAVERS, SHOWING HOW THEY PILE BRANCHES AGAINST FALLEN TREES



A BEAVER PUSHING A FALLEN BOUGH AGAINST THE EMBANKMENT IT IS BUILDING UP

A COLONY OF BEAVERS AT WORK SAWING UP THE TRUNKS OF TREES FOR AN EMBANKMENT

A DAY IN THE REAL WILD WEST

THE RED INDIAN WHO LET LOOSE THE WATERS THAT FLOODED A RANCH IN BRITISH COLUMBIA

HOW THE BEAVERS FLOODED THE MEADOWS

This letter from a father to his boy comes from a farmer far away in British Columbia. It tells the story of how a farmer and his Red Indian helper fought the beavers which dammed a stream, and changed its course so that the water flooded the meadows. "We have been blowing the beavers' dams to pieces," the letter begins, and the end of it is given below.

When I got to the ranch to-day, I found the water was right up into the barn-yard. Then I saw that trees were cut down right and left—willow-trees on the margin, and cotton-wood trees quite away from the banks. Other cotton-woods had been felled across the creek, and the bark was peeled off them. Then I knew the beavers had been at work. No axe had cut those trees down; they had been gnawed by the beavers. I knew that if I did not cut their dams this autumn, half our meadows would be under water next spring.

A BUSY BEAVER GNAWING THE TRUNK OF A TREE

So for two whole mornings I carried a brush hook on my shoulder and crashed through the underwood down by the creek in the Indian Reserve below our ranch. I went to old François, the chief, and he pretended he didn't know where the dams were; said he thought there was a dam down towards the lake, and he would tell old Black Billy, his brother, to trap them. On the second morning I heard a waterfall, and, knowing there was no natural waterfall near, I guessed it was a beaver dam, and soon cut a trail to the spot with my brush-hook. You should have seen it!

The beavers had got the water fairly banked up. Their dam was about four feet high on the lower side. They had got birch-bark, and cedar-bark, and the bark they had peeled off the cotton-wood trees, kneaded up with mud, and the willow branches they had cut down with their sharp teeth. Then the tops of the young live willows and alders growing on the banks had been bent down and buried under their mud and bark, where next spring they would shoot down roots into the bed of the stream, and shoot up branches above the water, until every stick floating down-stream would be caught against the dam and help to make it stronger and higher. The beavers had cut scores and scores of long poles, several inches thick, and these were laid in regular rows, with the ends pointing up-stream stuck in the mud, and the ends pointing down-stream stuck in the air.

You could walk across the dam well—the beavers had been plastering mud on the top. On the top of the dam I saw some old bones which the coyotes had carried there to nibble.

Having discovered this, I started for home. As I was going up the trail towards our cottage, whom should I meet but two Indians. One was Andrew. I said, "Hallo, Andrew, how are you? Who is this young fellow you have with you?" Andrew said, "That man Tom Andrew." I said, "I didn't know you had such a big son." The young Siawash, who was a very big fellow I had never seen before, grinned and said, "Andrew, me marry him daughter." So I knew it was Andrew's son-in-law. I then told them I had found a big beaver dam, and was going to blow it up with powder; and Tom, who seemed a jolly sort of young Siawash, grinned at that, and began to brag of the wonderful deeds he had done on the river drives. Well, the sun was shining very brightly, and the air was very still, but in the shelter of the woods everything was still white with frost. I had been fiddling about in the water, pulling out sticks and trying the depth, and had found it chilly work, so I encouraged the valiant Tom to boast about his deeds; and the end of it was that Tom, who scented lots of fun, had promised to help to blow up the dam.

After lunch I hunted up Tom. We took an axe and a knife, some fuse and caps, and six pounds of powder, as well as a box of axle-grease, and a piece of mother's old mackintosh which you youngsters had had in the bungalow. Then we made for the dam. I very soon saw that Tom knew what he was about, and, what was very important to me, he didn't mind a bit how wet he got with the icy water. Reaching down into the water among the sticks, he felt about for the best spot in the middle of the dam to place our charge. While Tom was busy at that, I cut the fuse and put in the detonator, and stuck it into a pound stick of powder. We put three pound sticks of powder into mother's old mackintosh, and greased the sticks well with the axle-grease to keep the water from penetrating. We then tied up the lot with string.

Tom took one of the willow poles the beavers had cut for us, and sharpened the thick end to a point with the axe. Then he made a little dam with moss and twigs and dead bracken, and having steadied the rush of water he made a hole in the mud with the pole. He stripped off his shirt and reached with his long arm down into the hole, and padded the bottom with moss. Then he carefully put our three pounds of powder into the hole, being careful to keep the end of the fuse dry—the rest of the fuse, which had to pass through the water, we had coated with grease. Then I handed Tom more moss and dead bracken, and he stamped that firmly but gently on top of the powder. Then he split the top of the fuse with his knife, and filled the cut thus made with a bit of powder. With the touch of a match the end of the fuse immediately began to sizzle. The moment it did so, Tom gave a mighty yell of 'Fire!' sprang up with a bound, nearly sending me head-over-heels into the stream, leaped off the dam, and ran like a deer through the brush. I followed like a lamplighter. Tom took shelter behind a big fir, and I watched from behind a cedar, and the next minute she went off with a bang. The sticks went crashing through the forest on all sides, while Tom and I, like Brer Rabbit, laid low behind the big trees. After the rain of sticks had ceased, Tom gave a yell like the Indian that he is, and dashed and crashed back to the water's edge. He wanted to see the stream rush through the hole we had made. I followed him. The blue smoke from the powder floated over the stream and through the forest aisles, and smelt, as burnt gunpowder usually does, like drains. The whole centre of the dam was torn away, and the stream rushed through at forty miles an hour. Tom danced for joy like a marionette. The ice above the dam, three inches thick, cracked and broke away in great sheets, like enormous plate-glass windows, as the water dropped from beneath it. The sheets would join together in the hole in the dam and stem the stream for a moment, and then Tom would clap his hands and yell like a band. When we had watched the water drop eighteen inches, we went home. I gave Tom half a bushel of apples, and he went away rejoicing.

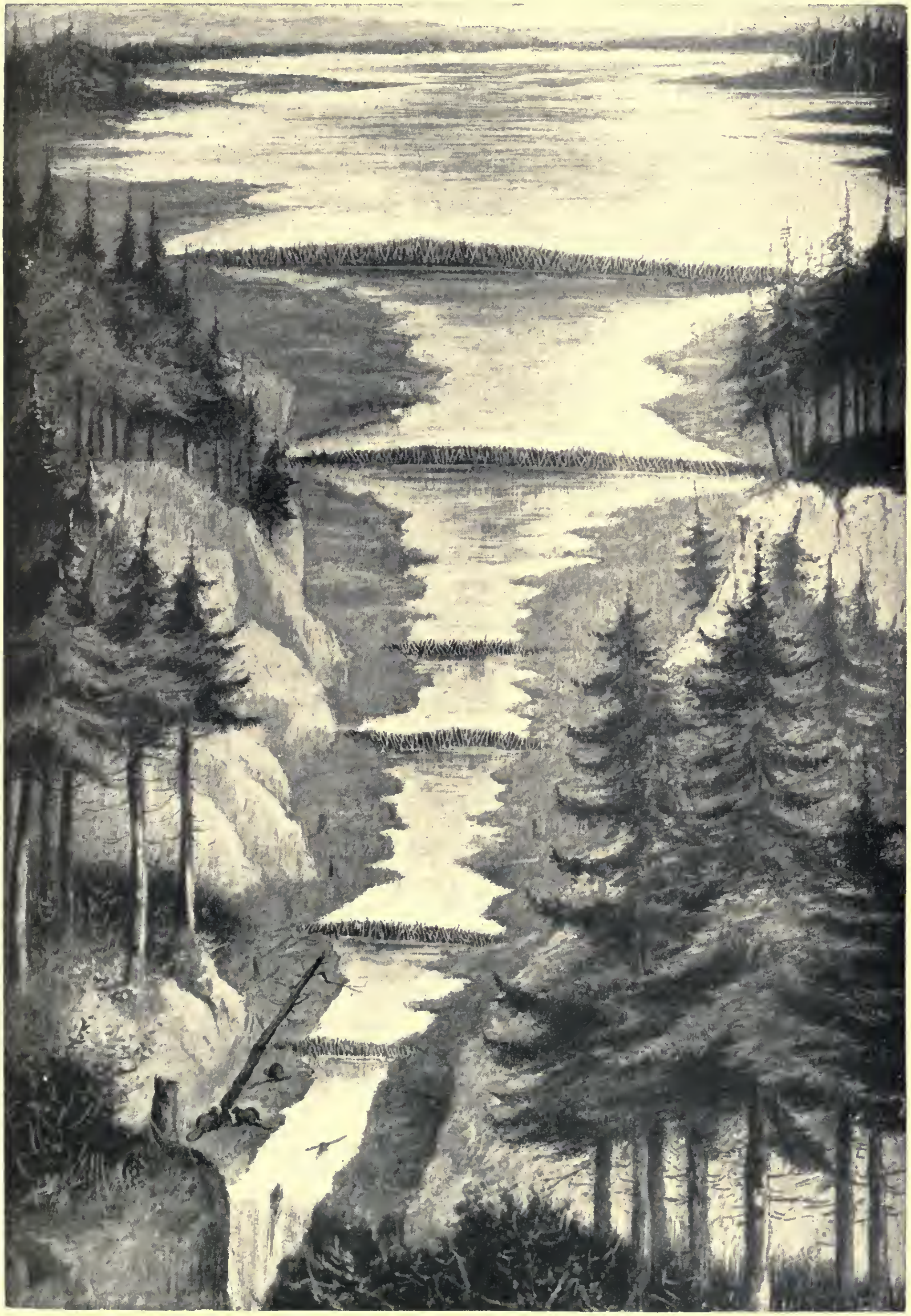
This interesting letter to a boy gives us a very clear account of how these intelligent little animals build their dams.

You know, of course, that these cousins of the squirrels live in colonies, or villages, and that their houses, or "lodges," are built in streams, with the entrance under the water. Here they live all winter, for, even if ice forms thickly over the stream in which they have built their dwellings, they can live comfortably on the food stored up behind the dam.

When spring comes, and the ice melts, the beavers leave the shelter of their embankments and roam about for a time. They have been living all winter on the bark of trees, and now they go out and get a change of diet. They look upon the water-lily plant as a choice morsel, and they are just as fond of summer berries as children can be. Still, even in the warm summer weather they are not unmindful of the winter cold, and it is in the pleasant summer nights that they cut down wood to build new houses. Then in the early fall they begin to build. Later on, when the first cold, frosty nights make them feel the need of warmth and warn them that winter is coming, they begin to repair the old houses, and make them snug and trim.

When the really cold weather sets in they become very busy, for then every house gets its last thick coating of mud, which they plaster with their fore-paws until it is quite smooth. The mud quickly freezes, and as it becomes as hard as a stone the enemies of the beavers can find no way of making an entrance through the round, dome-like tops of the lodges. If the tops of the houses were flat and square, the strong claws of a wolf might be able to tear holes in the roofs, at the corners. But the smooth dome gives him no place where he may take a hold, and, scratch and claw as he may, he can make no impression upon its surface.

WHO TAUGHT THESE ENGINEERS TO BUILD?



The marvellous engineering powers of the beaver are an everlasting source of wonder. Who taught these little creatures to store up water for their homes as the Nile dam stores up water for Egypt? The first dam in this picture was five hundred feet long and the last was at the edge of a precipice, so that the waterfall was checked by the work of the beavers.

HOW THE ANIMALS FILL THEIR CELLARS

THE FOX HIDES HIS GAME FOR ANOTHER DAY

THE ARCTIC FOX STORES UP FOOD FOR THE WINTER

THE HAMSTER RAT FILLS HIS UNDERGROUND BARNS WITH GRAIN

WONDERFUL THINGS THE ANIMALS DO

HOW THEY SEEM TO REMEMBER YESTERDAY AND TO LAY UP TREASURE FOR TOMORROW

THE WISDOM OF OUR LITTLE DUMB FRIENDS

IT is sometimes said that one great difference between mankind and the lower creation is that there is no yesterday or tomorrow in the animal mind ; that animals do not learn from the experience of the past to prepare for the future. Those who have had any close relation with animals will not readily accept this, perhaps.

The lover of dogs, for example, will tell us that the instinct of the dog does impel it to think of tomorrow and to make provision for the time to come. It hides its bone in order that, when it is hungry, it may dig it up. It remembers where it has hidden the bone, and will do battle for it against a dog bigger and stronger than itself.

To hide bones is a habit inherited by the dog through a long succession of ancestors stretching away to the days when dogs had not become domesticated. The first dog that hid a bone would go in secret to his store and eat while the others starved and died, and his offspring, inheriting the greater brain of their sire, would be wiser than the offspring of the other dogs. The wise dogs would become the ancestors of a line of wise dogs, and in course of time they would win the mastery of the dog world. The first dog that hid a bone must have thought of its " tomorrows," and, even in prosperity, a dog will hide a bone today, however unnecessary its thriftiness may be. It is like the squirrel at the Zoo. These come from the wilds, where for ages squirrels have survived through the rigours of winter on the food stored up in summer. At the Zoo there is abundance of food for them, winter and summer, but they store their nuts all the same.

There must be something like thought behind the hiding of a bone. A lion or a tiger, when it kills a cow or a buffalo, drags it away to a place of safety, eats as much as it can, and then retires to hiding, to sleep with one eye open, as we say, on the watch for prowling hyenas and jackals which would rob it of the fruits of its chase. A second and third night the big cat will return to its quarry, until the last fragment of flesh has been devoured. In seeking a place of security for its slaughtered prey, in lingering near to make war upon robbers and returning to take possession again and again, the lion or tiger decidedly shows consideration for the morrow, and so lives.

When we talk of an animal " thinking of tomorrow," we have really in mind the idea of his preparing for a winter of many tomorrows. Animals in lands where winter is severe have always a great problem to face when the turn of the season comes. They must find a regular food supply, yielding support day by day, or they must lay up provision to make good the shortage that will come, or else they must go to sleep and pass in utter unconsciousness the time during which the hard earth yields no provisions for them.

There is no doubt that foxes of many kinds have this habit of providing against the time to come. The British fox, which is perhaps the most wily of all wild animals, is sometimes called a stupid creature for its habit of killing more than it can eat. But it is not stupid. Given time and opportunity, the fox will carry away and hide all it kills, burying the bodies of its victims, not all in one place, where one discovery would sweep away the whole store, but in a variety of places. There is the morrow of the hunter to remember, but there is the morrow of the baby foxes, too. The little cubs, once they have begun to eat flesh food, must have their supplies, and these must be taken when they can be got, and must be kept for future use. Wolves and other beasts of prey take home food for their young in this way, and out of this habit arise the stories of children having been reared by wolves. Wolves do carry off native babies, in India and elsewhere, and men who have given serious thought to the many stories about this have come to the conclusion that possibly now and again a baby has been carried by a wolf to her cubs when they have been well fed, that she has brought in more food before they have become hungry again, and so the baby has been allowed to live, and has settled down in the family like one of the cubs, nurtured by the milk of the mother-wolf until it has been able, like the cubs, to eat solid food. Romulus and Remus, the founders of Rome, are said to have been brought up by a she-wolf in this way, and to this day the people of Rome, as if they believed the story, keep a live wolf in their honour.

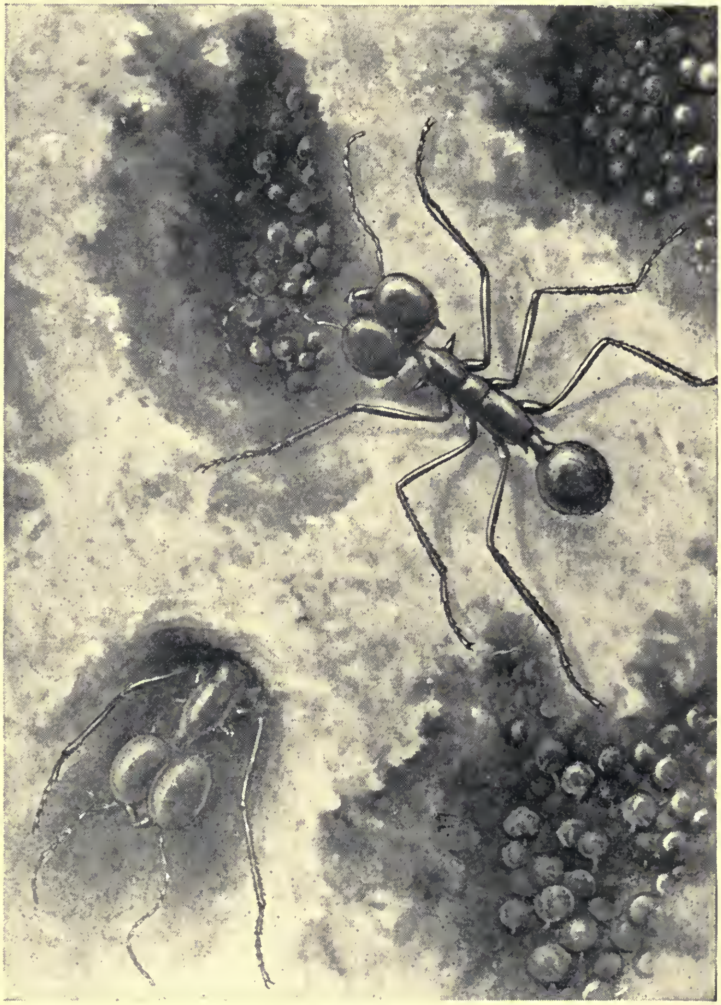
THE JAY STORES UP THE ACORNS FOR ANOTHER DAY

It is quite fair to ask why, if some animals care for tomorrow, others should succeed as well without doing so. Wise Nature has made provision for some. The power to sleep through a long period of scarcity is a great gift. It applies not only to the common hibernating animals; certain fishes and reptiles have a summer sleep. Lung fishes, for example, when the water of their streams is about to dry up, bury themselves deep in the mud, and rest there, immovable and inert, so that when they are in this state they may be carried from side to side of the world without waking. But other fishes have to face the prospect of streams and pools dried up, and these must care for the morrow or die. What the thoughtful little climbing perch does is to fill his gills with water, then stump off on his fins across dry land to where, by some marvellous means, he knows he will be able to find fresh water.

The migration of this little wonder of the river or the pool is every bit as marvellous in its way as the migration of a bird. Nature helps in other directions. Ruminants—that is to say, such animals as cows, camels, antelopes, and some others — are helped, not, indeed, to withstand a full winter, but to do that which no other animal can do—to delay the process of digestion. The food is taken hurriedly, and the animal can then make a long march to safety before lying down to chew the cud —that is, to bring the food to the mouth to be properly masticated ready for digesting. The camel can do more than this, for it carries in its stomach water cells enabling it to withstand thirst for several days on its march in the desert. But this has nothing to do with taking thought for the morrow; it is one of Nature's marvellous aids to animals.

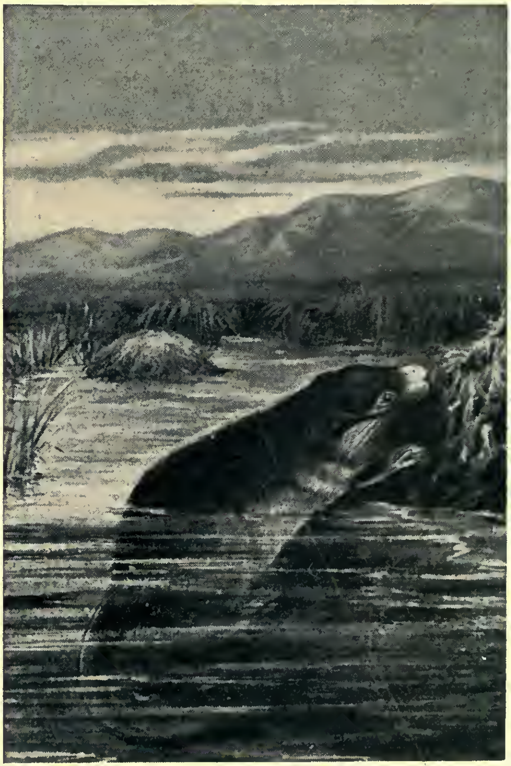
Nature makes many experiments, and it is likely that one of her great trials in this direction has been made with the mighty whale. It is amazing to know that this mighty ocean animal has a stomach somewhat resembling that of the land animals which chew the cud. We cannot tell through what changes this organ has passed, for, though we find many fossil whales, all the soft parts are gone. We know, however, that whales used to walk on dry land. May not the curious stomach be taken as suggesting that when whales were land animals they may have had digestive systems similar to those of the cow and the camel—that land whales chewed the cud? The only thought for the morrow that whales now seem to show is in the care of their young, which they shield and shepherd with the greatest skill and affection. But things so small as the paradise fish, which blows the prettiest cradle of froth bubbles for its babies, can match the lordly whale in this respect, and the small stickleback is, for its size, at least as courageous and skilful in the defence of its family, so we may let the whale go by.

It is really among the smaller animals that we find greatest evidence of care for the morrow. The dog and cat families, which include nearly all the great flesh-eaters, show care in the way we have seen, but they are far surpassed by the little animal that makes a skilful home and stores it with provisions. The ant, with his barns and dairy and his cultivated garden, the birds which lay by nuts, the beetles and bees which cut up material, fashion nurseries and dwelling-places and fill them with food, appear to us far more like thinkers than the great bear which eats and eats until it is fat, then gives itself up to a sleep lasting all the winter. We know so much about the clever little animal and insect workers that perhaps some of us come to regard their care as a commonplace thing, but it is marvellous enough.


THE PARASOL ANTS WITH THE FUNGUS-FOOD GROWN ON LEAVES

If we take the birds we find the same thing, not only in the bird making provision for itself, but in the way in which it brings up its young. Of the first kind of care, let us take the butcher bird or grey-backed shrike, which is a bird well known in European countries. Its food consists of beetles, grubs, bees, and other insects, tiny reptiles, mice, and even little birds. It is, in reality, a small bird of prey, and we are not to dislike it for its habits, any more than we dislike the eagles or the hawks, which take other birds. Now, the butcher-bird, as we call him, is a very active little fellow, and never lets an opportunity slip of capturing prey. A vulture will eat until it rolls over, gorged. The shrike, however, has a hearty but moderate appetite, so that when it has collected food enough for present needs it remembers tomorrow, and still continues to collect, storing its new supply. Having killed its victim, it carries it to the top of the high bush where it has made its nest, and there impales it on a thorn. As the day proceeds, and the hunting brings in more food than is required for the hour, the little store grows, resembling a tiny shambles, and so we call the shrike the butcher-bird. We may assume that if the red-backed shrikes continued this habit long enough, with forms of food capable of lasting, we should in time see a race of shrikes that would store enough food to last through the winter. So far no bird has succeeded in performing this feat. The insect-eaters must fly from us when the cold weather comes, or must change their diet, adding to it enough to make up for the things they miss. Our handsome squawking friend, the jay, banquets luxuriously on a field-mouse, but he cannot obtain a regular supply of these, so he takes such fruits and berries as are in season, and when the acorns ripen he bethinks him of the morrow, and buries some for future use. We owe him half the oak forests of England, for he has been the great acorn planter. But the merry, thoughtful little squirrel has helped him. The squirrel is as busy as an ant, and buries his acorns round about his tree in places where he can pop down from his nest when he awakes to stretch his pretty limbs in winter.

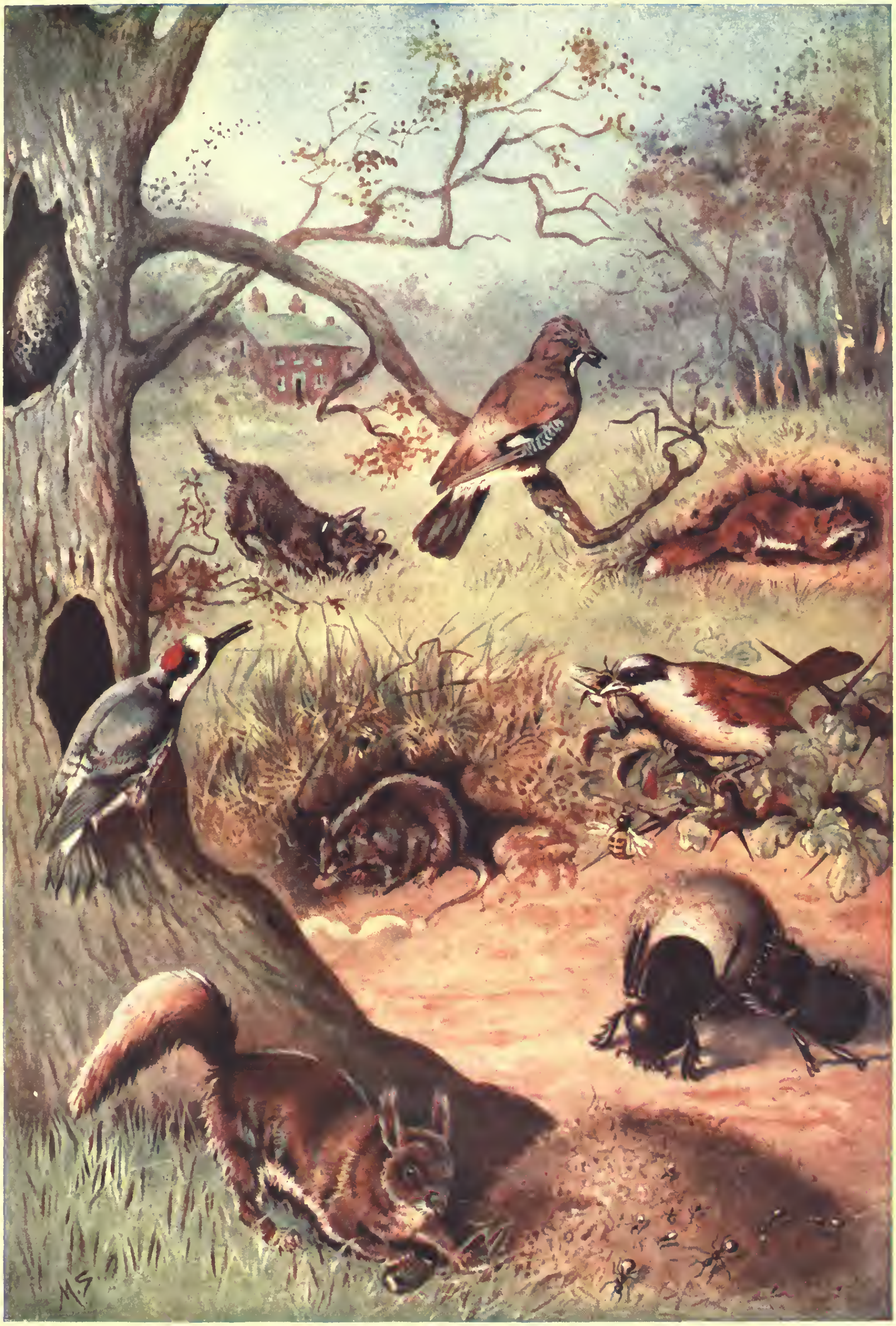
THE SQUIRREL HOARDS HIS NUTS FOR HARD TIMES THAT ARE COMING



THE MUSK-RAT LAYS UP FOOD IN HIS MUD STOREHOUSE IN THE MARSHES

The jay and the shrike are not the only birds to have this storing habit. There are two woodpeckers which seem to think of the morrow. One is a Californian, which eats insects in general and ants in particular as long as they are in season, and collects acorns to store for the winter. Making many holes with its powerful beak in tree-trunks, the woodpecker thrusts an acorn into each opening, so that when hard times arrive it is able to go to this larder and eat the food so industriously stored in time of plenty. This woodpecker has a sort of cousin in another woodpecker peculiar to Mexico, but the Mexican has gone a step farther than the Californian. This one also is an insect-eater for the favourable part of the year, and also collects acorns as they ripen, but, instead of thrusting them into

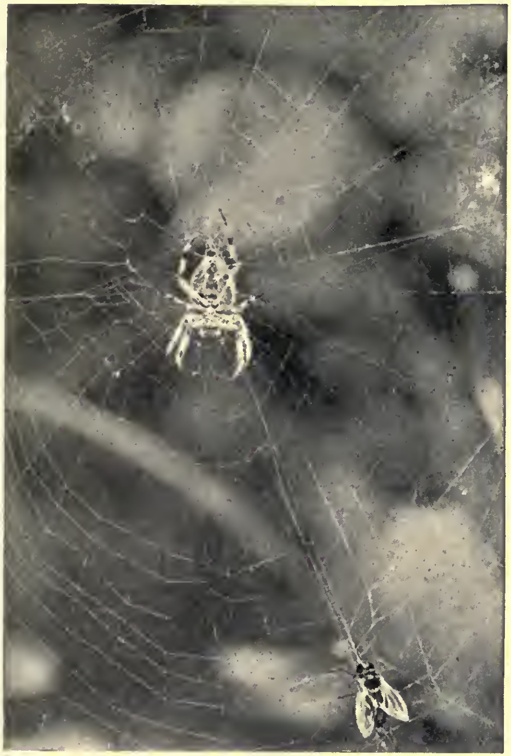
A WISE FAMILY PREPARES FOR TOMORROW



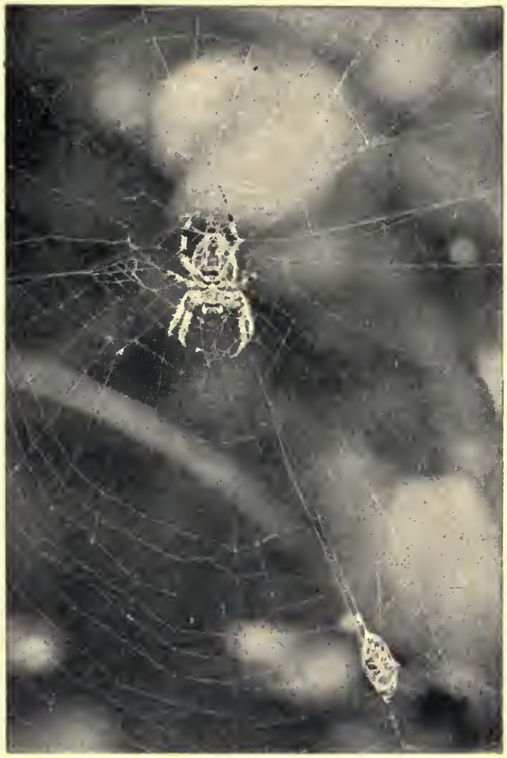
WILD LIFE LAYING UP FOOD FOR ANOTHER DAY

The squirrel hides his nuts, the fox his game, the dog his bone, the rat his prey; the woodpecker and the jay store their acorns; the red-backed shrike makes sure of his victims; the scarab beetle brings home its ball of food; the bee stores up its honey; and the ants fill their underground larders with new supplies.

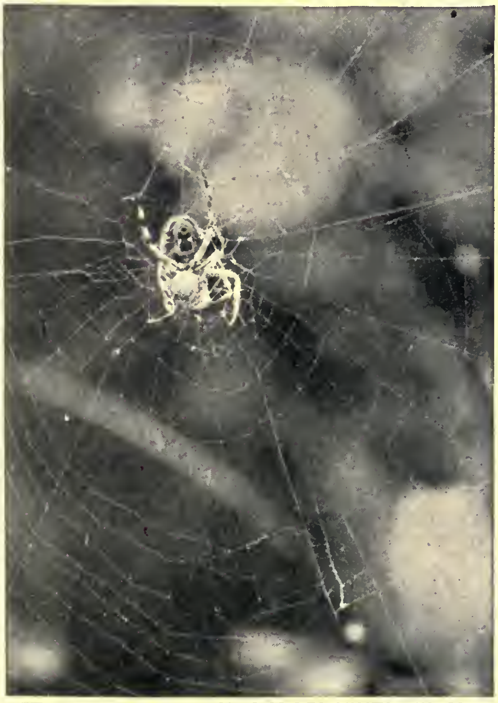
THE SPIDER LOOKS OUT AND SEES THE FLY



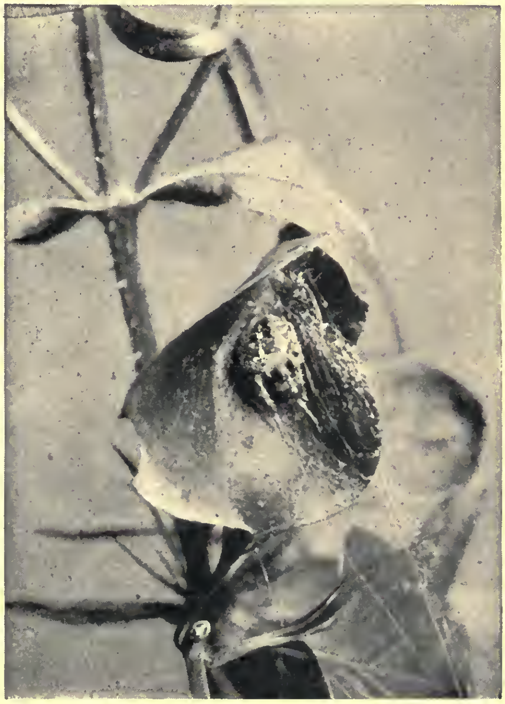
THE SPIDER LOOKS OUT UPON THE WORLD AND SEES THE FLY



THE SPIDER WRAPS UP THE FLY IN A WEB BLANKET. AND RETURNS TO THE MIDDLE OF THE WEB



AFTER TEN MINUTES THE SPIDER VISITS HIS PREY, CUTS THE THREADS, AND CLIMBS BACK



THE SPIDER CARRIES HIS VICTIM TO HIS DEN. WHERE HE BANQUETS AT LEISURE the boles of trees, it tunnels the stems of big plants which have flowered, and from which the sap has evaporated. In the hollows of these stems the woodpecker places his store. By the time he sets to work the stalk is nearly hollow, and the bird first drills a hole towards the bottom of the stem and pops in an acorn. As that falls down inside the stalk he puts in another, and then another, until this part of the stem is full. Then he makes another hole, higher up, and fills that space, adding perhaps a third store still higher up. If the stem were hollow throughout, doubtless it would save time to make an opening at the top and fill up from there. But the way is not clear throughout; there are stoppages in the stem, and our woodpecker seems to peck and bore as if he knows it. When the time arrives, the bird picks out an acorn as he needs it, and is happy, independent of the poverty of the land parched around him. Surely that seems to suggest some sort of appreciation of the fact that after the days of plenty follow the days of scarcity, although even these birds do not provide for the whole winter.

THE MUD-WASP CREEPING OUT OF HER MUD NEST ON A WINDOW-FRAME

DEAD CATERPILLARS PLACED NEAR THE EGG FOR THE YOUNG WASP NOT YET BORN

Taking these examples of industry by birds, we must agree that, if they do not show a suggestion of thought for the morrow, they are at least an astonishing imitation of thought. Add to them the way of the sand-grouse and the woodcock. The sand-grouse is a desert bird, but its babies must have drink, so the parent birds fly, one at a time, to distant water, bathe their feathers, and then, flying back to the nest, let the little ones nestle amid the moistened wings and draw the water out of them. The woodcock's food is found in marshy land, but sometimes, for safety's sake, the parent birds build away on high-lying land. But the babies, if they are to live, must have food, so, instead of the old birds bringing the food to the babies, they carry the babies at night to the food. The old birds catch up the little ones between their legs and fly off with them to the feeding-ground, returning with them when dawn and danger draw near. If the wise birds did not do this, there would be no tomorrow for today's young woodcock.

So that even the birds have some care for the morrow, though, as we should expect, we find a higher power of this kind among the animals. Silence and observation will show us the squirrels at work any autumn day in woods where oaks and beech-trees are. The handsome little rascals do great damage at times to the tender shoots of trees, which are, indeed, their staple food supply during the early summer. They do not eat the acorns as soon as they ripen, but seem to regard them as a reserve, burying them for future use, as the beavers bury bark-covered wood under their ponds for the days when the waters will be frozen.

A great harvester of Asia, and of certain parts of Europe, is a field-rat which gathers into his barns as much as a bushel of grain. The hamster, which belongs to the rat family and is common in Germany, is not merely provident, but greedy, for an old animal will excavate four or five underground barns and fill each with grain. This gnawing creature thrashes his grain, so to speak, before garnering. He twists and twiddles the ears between his paws until the grains are loosened, and carries away the chaff and keeps the grain. One of the voles, one of the best-established colonists of Siberia, digs up roots in the autumn and gathers them into his subterranean storehouses. This is a big undertaking, for the root has first to be excavated and torn from the soil, then dragged for some distance to the home, and finally carried down below. Incredible as it may sound, this little animal stores as much as thirty pounds of roots in this way to keep him alive through the rigours of a Siberian winter; and, as these roots are food for men as well as for voles, many a human life has been saved by the unearthing of these stores in times of famine.

THE SQUIRREL AND THE NUT

THE DOG AND HIS BONE

The same may be said of the camas-rat of Idaho, whose stores were valuable to the Indians. There is not as much cleverness, perhaps, in the work of an ordinary ant as in an intelligent dog, or elephant, or horse, or monkey, yet if we take dogs in packs, monkeys in troops, horses and elephants in herds, we find nothing in their actions to match the united action of the insects. Look at the work of a beehive. It is all care for the morrow. The cells are made for the queens, drones, and worker bees; the nectar and pollen are gathered and stored. Every worker bee gathers more than it could possibly eat in its own lifetime, gathers it from the flowers and carries it back to the hive, where its store is unloaded by bees waiting there for the purpose, like railway-men at a goods-receiving depot. The honey is packed away in the cells, sealed down, treated with a little formic acid so that it shall not turn sour, and there is the supply for the winter, on which the baby bees will be nourished, and from which the workers remaining at home are fed.

Higher still is the work of the ant. Our common ants mine, make tunnels and roadways, build storey upon storey of apartments as high for them as sky-scrapers are for men. They gather food and keep it; they have their nurses and queens; they make war for slaves, like a Roman Emperor. In much of this they are matched by the bees, whose architecture is even more wonderful than that of the ants. But it is in the treatment of their pets, their cows, dairies, and gardens that the ants seem more remarkable than the bees. The ant has discovered that the aphis, or greenfly, gives a sweet juice, and the ant "milks" the greenfly cow. Not only that, but towards the end of summer, when greenflies die off, the ants collect eggs of these insects, carry them down into their cities, preserve them with their own eggs, and in the warm days of spring bring them up into the sunlight to hatch. They imprison the aphides, building pens or sheds for them, as we make sheds for our cows, and they actually carry below food which the aphides need, but which the ants do not.

The harvesting ants toil with enormous energy in carrying grain to their barns, grains of wheat and barley, seeds of shepherd's purse and of flowers. It may require the efforts of a dozen of these little insects to bear away a single grain, but great numbers of grains are taken down into the earth and stored in tiny granaries. Now, in the moist, warm earth, we should not be able to prevent the grain from sprouting, but the ants do. We do not know how they do it, though we suppose they bite off the radicle—the nucleus from which the life of the plant springs.

Solomon wrote that "the ants are a people not strong, yet they prepare their meat in the summer," and he was right. They gather their grain when it is ripening, and eat it when food is scarce. Some are believed actually to plant a growth of what is called ant-rice, for while they keep a big space round their nests completely clear of other growths, they always have this ant-rice there on the surface of the nest and round about.

The parasol ants are still more mystifying. They march in long and well-ordered armies, with workers in the centre and soldier-ants on the flanks; they march to the coffee-trees and orange-trees, climb up, bite pieces out of the leaves, throw down the fragments to those waiting below, then march home all in good order as before. These fragments of leaves are carried down into the city beneath the ground — a really marvellous example of insect organisation — and there stored and tended; and on the leaves there springs up a fungus which forms the food of the ants.

A PROCESSION OF PARASOL ANTS CARRYING LEAVES TO THEIR LARDER

The photographs illustrating this article are by Messrs. Hinkins & Son, J. J. Ward, C. P. Casstine, J. Holmes, and Miss F. Pitt.

Of all the ants these are supposed to be the most highly developed, but the little yellow ants of our gardens, which take the trouble in October to collect the eggs of the aphides, storing and caring for them until March, waiting for the young to be hatched and then carrying them into the daylight, placing them on the stems of flowers, building pens round them, and at last milking them of their honeydew — these clever little neighbours of ours are not to be despised or lowly rated.

The truth is that bees and ants and wasps move us to view the lower creation with wonder and respect. In their lowly lives, as in the heavens themselves, we find ourselves in the presence of something greater than we understand.

A GAME WITH A CHIMPANZEE

A TALE OF THE LONDON ZOO HARD TO BELIEVE

"SHUT your eyes and open your mouth, and see what I will give you!" It is a man who is speaking, but he is not playing games in a house with children—not with human children, at any rate. Really, they *are* children who share his game, but they are ape children, young chimpanzees, two of them, the son and daughter of some grim and fearsome wild man and wild lady of the woods of distant, steaming Africa.

Here they are in busy London, sitting out on a seat in one of the public walks of the Zoological Gardens, free and unfettered, enjoying a game of romps with their friend and master, Mansbridge, the head-keeper of all the apes. The man who writes this story sits beside them, secretly wondering whether they will turn round and want to bite his head off.

When we first come face to face with the man-like apes, two thoughts strike us. They are more like human beings than we had realised, but they are uglier than we had thought. They have hands differing very little from ours. Their feet are constructed upon the same plan as our feet, but they have used the great toe as a thumb, and we have not. They have employed the feet as climbing hands, and have not, therefore, learned to walk upright as we have; they have preferred to climb among the trees. When they descend to the earth, they cannot walk any distance erect, but have to use the hands as supports.

We have, however, to note that, because they cannot do the things that human beings find easy, apes are not to be regarded as brainless. They have exactly the same type of brain as man has, it differs only in being smaller and of poorer quality than ours. The ape remains a wild, lowly animal because its brain, upon which action and progress depend, has not been developed. But, undeveloped as it is, the ape's brain is the finest in the world next to man's. Nearly all the organs, nerves, muscles, and bones of the higher apes agree with man's, but the brain most of all.

We must bear these things in mind when we step into the apes' house. Here, before us, we see the wild, untutored cousin of the lord of creation, and it is marvellous to discover how his actions and emotions resemble ours.

There was for some years a chimpanzee at the Zoo, named Sally, with whom a great professor conducted experiments to test her intelligence. She was taught to count. If you asked her for one straw, or two, three, four, or five she knew what you meant, and, picking up the straws and putting them, one by one, into her mouth until she had collected the whole, she would hand you the correct number. No ape had ever done such a thing before, and it made her famous. She was an educated ape, and the story of her scholarship was printed in the scientific papers of all lands. Now, the man who taught Sally was none other than our friend Mansbridge, the keeper of the apes to-day. He has been acting the part of fairy godfather to all the apes that have come to the Zoo these thirty years and more, and he it is who now cries, "Open your mouth and shut your eyes!"

The chimpanzees, we soon find, are the keeper's favourites, because, although they may not have finer brains than the orang-utangs, they are more easily taught. They cannot all be made to learn lessons. There are sharp chimpanzees and there are dunces. They vary as much as children vary; but as the number of chimpanzees in his care is always small, naturally he cannot show as many bright examples of learning as the teacher of an ordinary school-class can. And the brightest ape's scholarship is, at best, not equal to the knowledge of a child just starting lessons with its first governess.

"But let me show you what my babies can do," says Mansbridge; and he turns towards a large cage which is in the open, sheltered by the back of the splendid great new ape-house. "My babies!" you think to yourself. "What a bother! I wanted to talk about apes, not about this good man's babies." But before you can mention the matter to Mansbridge he says, "These are my babies," and points to Fanny and Jerry, two young chimpanzees in the cage. Fanny is the larger, though slightly the younger, of the two. She is five, and Jerry is seven, and both have been three or four years in the Zoo.

FANNY AND JERRY CLING TO THE KEEPER

A LITTLE SHY ON SEEING THEIR VISITORS

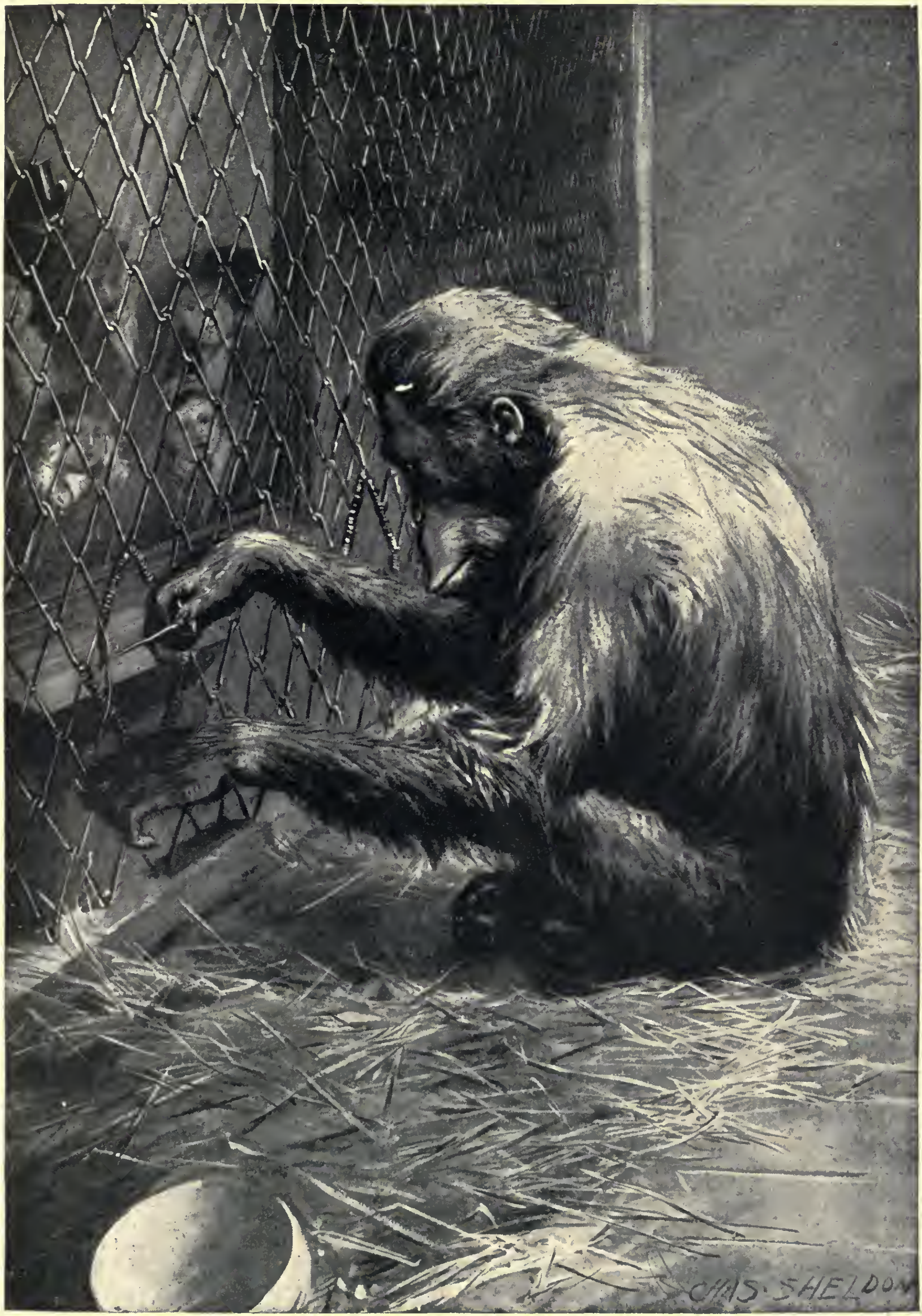
Suddenly there is a terrific hullabaloo from the cage. Jerry has been pinching or slapping Fanny, and she is screaming with temper, and he is screaming back to show her that he is not sorry, and does not care a bit.

"Now, then, you bad things!" cries Mansbridge. "Stop that noise at once!" The apes become instantly as silent as mice. Fanny wears a look upon her face as much as to say, "Please, teacher, he did it." And Jerry's brown, wrinkled features might almost, but not quite, be said to flush.

"Come on, Fanny, you shall go out with me, and he shall stay at home for being a bad boy," says Mansbridge, as he opens the door. But Jerry is so upset at this that he has to be forgiven so that he may trot out into the grounds with her.

They look very happy, and are quite good friends again by this time. "Now you can have a biscuit, but only one—we'll all have it," says Mansbridge. Someone holds out a biscuit. "Take it, Fanny," says her keeper. Fanny rises, takes the biscuit, and, at the word of command, makes a salute—a "salaam"—as we see her and Jerry doing in

JACOB ORANG-UTANG HAS AN IDEA



It can no longer be said that the man-like apes never use tools. Here is Jacob, the orang-utang, at work with a stout wire which he made to use as a lever for tearing away the binding of the "armholes" in the front of his cage. Getting the wire from the orang in the next cage, Jacob turned and twisted it to his purpose, bending one part in the shape of a handle, and straightening the rest to make a strong and useful "pick." The tool shown on page 293 is worn to a smooth point.

our photograph. But in the picture Fanny, who is usually so sweet-tempered, is feeling cross about something, and is pouting so ill-temperedly that none of us can doubt she has been copying some sulky child. But that came later. At the present moment Fanny is holding the biscuit, and, with charming manners, refuses to begin her meal until her host invites her. "Give it to me, Fanny," Mansbridge says; and without hesitation she hands it to him. You would not find a house-dog so ready to part with a meaty bone.

HOW MASTER JERRY KEPT THE BIG PIECE FOR HIMSELF

Mansbridge breaks the biscuit into two large and two small pieces, and hands one of each to Fanny. "Now, give me my piece first, please," he says; and the good-natured creature gives him the larger share and eats the smaller piece herself. Mansbridge now gives the other two pieces to Jerry, asking at the same time for his own share. Master Jerry gives him the small piece, and keeps the larger for himself. Ill-mannered Jerry!

The keeper places a grape on Jerry's broad nose, saying, "Eat that without using your hands." Jerry cautiously tilts his face downward, shoots out his flexible lower lip, and catches the grape as it falls. Then he gives Fanny a grape, and orders her to feed Jerry with it. Fanny at once pops the grape into Jerry's grinning mouth. Next Jerry has to follow suit, and reluctantly slips his gift between Fanny's lips.

"Now, Fanny, shut your eyes and open your mouth, and see what I will give you," calls Mansbridge. She does so, or seems to do so, but Mansbridge's quickness catches her deceiving.

FANNY SHUTS HER EYES AND BALANCES A GRAPE ON HER NOSE

"Cheat!" he says. "You've got one eye open!" And so she had; she was slily peeping with the right. "Shut them both," orders the schoolmaster. This time Fanny screws up both eyes as tightly as if she were swallowing a dose of nasty medicine. Mansbridge keeps faith with her, and, when given permission to reopen her eyes, she finds a sweet grape balanced on her nose. She knows what to do with that.

Mansbridge is like a gamekeeper or a pet uncle—he has lots of big pockets with all sorts of surprises in them. From one he now produces a juicy apple, and, handing this and a pocket-knife to Fanny, he lets her cut a piece and eat it. Then she has to cut a piece for Jerry, and you will see in the photograph how she uses the knife as if it were a fork, and gives Jerry a piece on the end of the blade. Then Mansbridge pops the rest of the apple into his pocket.

But Jerry thinks that if Fanny is permitted to carve an apple, he might do so, too.

"Hoo-hoo, hoo-hoo!" he cries.

"What do you want?" asks Mansbridge.

"Hoo-hoo, hoo-hoo!" answers Jerry.

"Oh, I can't be bothered now! All gone, more to-morrow," says Mansbridge, just to let us see what Jerry will do.

Jerry does what a three-year-old child would do—he howls with all his might. Look at him in the picture, howling with disappointment and temper.

"Well, if you want it, you must just find it yourself; I sha'nt!" says Mansbridge. "See if it is in my pocket."

Jerry gets up very excitedly, and feels carefully in the pocket. He cannot find the precious apple. He trembles with excitement, and, looking into his friend's face, complains, "Hoo-hoo, hoo-hoo!"

"All right, try the other pocket," says Mansbridge, turning round.

IN THE PRIVATE APARTMENTS OF THE KEEPER AND HIS APES

Jerry does so, and, with agitated fingers, brings out the apple and receives his reward from the keeper.

"Now, then, time you were at home. Off we go!" says the keeper.

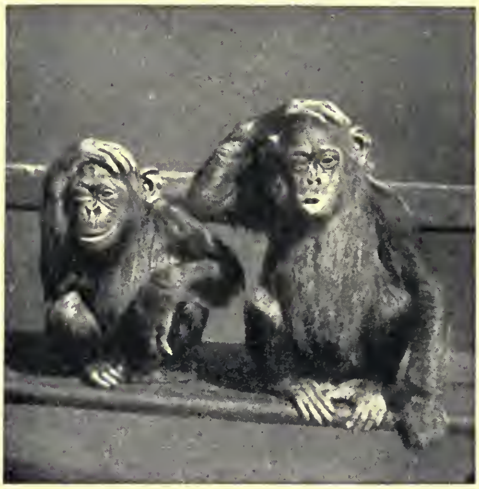
Fanny sidles up into his arms, Jerry rides pickaback, and home they go together, in the way we see in the photograph.

When one human being visits another the call is generally returned, and now that the apes have visited us in the gardens, Mansbridge invites us to visit them. Of course, the invitation does not mean the guests entering the ape children's cage; it means an interview in their private apartments. The cage is only their outdoor quarters. They have the nicest apartments imaginable behind, and we go round, enter the house by a side door, descend two or three steps, and enter a narrow corridor, made light and bright by walls of white glazed tiles, and by the glass panels of doors which lead into little rooms to the right. There are three of these rooms, and you cannot help saying to yourself, "The private apartments of the three bears."

Mansbridge takes four of us into the first room. A hurried hunt through the grounds has discovered little Marjorie falling in love with the sea-lions. With her are Goldenlocks, her pretty cousin, and another young lady.

"This is *my* kitchen," remarks Mansbridge proudly; but he says it when Fanny and Jerry are not present, and they know better than that. You will see that, whatever their tutor may say, they regard that room as their very own. And they are such wise young people that surely they must know.

"Here you see the dishes and other things that the apes use," Mansbridge explains. "They are like children; each must have its own dish or pannikin, then there is no quarrelling." There were the pannikins, neatly set out on the table, all spotlessly clean. There were quantities of new milk, stores of fruits and other nice things, for all the world like the larders in the fairy stories. But there were nasty things, too—medicine, which Jerry and Fanny take every morning. They suffer from exactly the same kind of complaints by which we are troubled, and they have exactly the same sort of medicine. The young chimpanzees swallow, every morning, a dose of tonic, which perhaps takes the place, in some measure, of the wild foods they would have to keep them in good health at home in their native wilds. It is very good of them to take their medicine in this way, but they ought not to boast about it, for the huge orangs take cod-liver oil in the winter, and smack their lips with enjoyment over it.



JERRY AND FANNY SAY GOOD-MORNING

JERRY ANGRY BECAUSE FANNY DRANK THE MILK

FANNY FEEDS JERRY WITH PIECES OF HER APPLE

Mansbridge puts two chairs ready. Then, "Now come and see them in their own room," he says. We all walk out into the corridor, we pass the next room, and stop at the third. It is entered by an ordinary door, which has glass panels in the upper half, and a lock and handle of the usual type. The keeper unlocks the door, but does not open it. Instead, he knocks hard, and cries:

"Fanny, I want to come in. Open the door for me."

Such a scuffling inside we hear, and, looking through the glass, we see a dark figure bounding across the straw. She rushes to the door, turns the handle, opens the door, pops her head outside with a look of inquiry. But she does not want either to ask names or to receive cards. She places her right hand on the inner handle of the door, her left hand upon the outer handle, and, hoisting herself up, swings to and fro upon the door with all the happiness of a ploughboy riding on a farmyard gate.

"Good," remarks Mansbridge approvingly. "But I want you both in the kitchen. Come on, Jerry." Jerry trots up and takes his master's

THE KEEPER PUTS A GRAPE ON JERRY'S NOSE

"OPEN YOUR MOUTH AND SHUT YOUR EYES"

FANNY FEEDING JERRY WITH MILK

hand. "Fanny, you can wait here for me, and for goodness' sake stop swinging on that door before you nip your fingers." Fanny cannot resist the temptaton to have another swing. "All right, my girl," says Mansbridge. "You'll just come along with me *now*, and you'll just have to walk by yourself." And he marches off ahead, leaving Fanny, to Marjorie's mingled amazement and delight, to waddle along the corridor in the midst of the guests. And so the kitchen is reached.

Jerry and Fanny trot nimbly to their chairs, and Mansbridge produces a bunch of fine black grapes from his wizard's cupboard, telling Fanny to balance one on her nose. She lets it fall, and it rolls under her chair.

"She *always* does that in here," Mansbridge remarks. "Do you know, I believe she does it on purpose, in order to get one extra. You will see what happens."

He gives her another grape, and this time she makes no pretence, but balances it, catches it in her mouth, and eats it. Suddenly Mansbridge, pretending that he had forgotten, calls:

"Here, Fanny, don't swallow the skin. Give it to me." And he holds his hand towards her. Fanny very carefully blows a bubble.

"This is how she shows that she has swallowed the skin," the keeper explains; and he gives her a third grape, saying: "Now, this time remember *not* to eat the skin."

Fanny munches her grape very deliberately. "Come, the skin, please," commands her friend. Fanny goes on munching, determined to get the last drop of flavour from the skin before parting with it; then she gives it to Mansbridge.

"Are you sure you haven't got any more?"

Fanny blows another bubble between her lips, and at that sequel Mansbridge knows that she has swallowed only the pulp of the fruit and rejected its envelope.

Next, in order that Fanny shall not be conceited by doing all the tricks, Jerry is allowed to feed her and himself with grapes, and the last of the bunch is soon gone.

Mansbridge turns to get a bowl of milk, and the moment his back is turned, Fanny stands up on her chair, reaches a long arm underneath, snatches up the fallen grape, which by this time we had forgotten, pops it quickly into her mouth, and sits down again as innocently as if nothing had happened.

Now we pass on to the bowl of milk, which is handed to Fanny. She holds the bowl in her right hand, and with her left hand she feeds Jerry, a spoonful at a time. She is a good, generous creature, but she could not help rolling her expressive eyes as Jerry smacked his lips and joyfully took the milk which she offered. She found this a trial, and it was very amusing to see how slowly she fed her companion, for when Mansbridge said, " Now you can have the rest for yourself," she spooned up the milk and drank it with as much eagerness as if she had not seen a bowl of milk for a month.

When the little " At Home " came to an end, Mansbridge told his pupils that they must return to their own room. Gentle Fanny got down from her chair, put her hand in her guardian's, and went peaceably enough. But not so Jerry. He seems to hold that the kitchen, with its pots and pannikins, is *his* alone, and he protested against leaving it. He began to " Hoo-hoo, hoo-hoo ! " in the most dismal and discontented way.

" Hoo-hoo, hoo-hoo, hoo, hoo, hoo ! " he wailed, his voice rising higher and higher; and as he wailed the old nursery rhyme came back to mind—

> I do not want to go to bed
> Naughty little Nelly said.

He was grumbling all the way back to the nursery, harder and harder all the way, and by the time he arrived he was in a regular baby temper. Mansbridge lifted him on to a swing, but Jerry would not swing; instead, he climbed up one of the ropes, doing a clever gymnastic trick without thinking about it, and holding himself there, stiff and erect, in a way that few human gymnasts could equal. And he continued his " Hoo-hoo ! " outcry until his guests left him.

But before leaving the private apartments of the ape-house, the visitors were conducted into the adjoining room, where they found two silvery gibbons, one in his own little house built in the room, the other in a cage outside in the grounds. The room is built on a plan similar to the chimpanzees', so that the

FANNY POLITELY TAKES THE SMALL PIECE OF APPLE

FANNY CHIMPANZEE KISSES HER KEEPER

FANNY FEELS IN THE KEEPER'S POCKET FOR A GRAPE gibbons have only to nip through the window to be out in the open air, but behind the bars of their cage, of course. The gibbons are of different ages. There is Jimmy, who is four years old, and has been for years at the Zoo; and there is another who is quite a youngster. So juvenile is he that he cannot yet be allowed out to play with the older gibbon, lest Jimmy should be too boisterous.

JIMMY APE, PROBABLY THE MOST WONDERFUL GYMNAST IN THE WORLD

Gibbons, we all remember, are the most athletic of all the man-like apes. These are they which perform such marvellous flights among the trees, swinging themselves great distances from bough to bough with such rapidity as to make it difficult for the eye to follow them. Now, Jimmy is probably the most wonderful gymnast in the world.

In his cage indoors Jimmy has a round horizontal bar of wood, fixed from the wall to the wires in the middle of the structure, and it is on this that he gives his performance. He was in the outdoor cage when the visitors called on him. Mansbridge went to the window and gave a signal, and in popped Jimmy. He skipped down on to the floor and ran very rapidly to and fro. Yes, he *ran*, ran like a human being, erect, swiftly, but carrying his long arms twisted up over his head, as though balancing a weight. But the running was excellent, and it was wonderful to see it. Here was an ape which had mastered the first secret which helped man in his rise in the scale of creation, the ability to walk on two legs instead of running on four.

A CLEVER PERFORMANCE THAT NO BOY OR MAN COULD DO

Mansbridge opened the door and called, "In you go, Jimmy." The gibbon entered the indoor cage with a bound, and shot up on to his bar.

"Now, then, the grand circle, please," cries the keeper. Every boy who has done any gymnastics knows what the grand circle is. You hang at full length, grasping the horizontal bar with both hands. Then you give yourself a swing, and round and round you go, stiff-armed, like the spoke of a wheel. And that was the trick that Jimmy did. But there is a difference between Jimmy's performance and that of the human gymnast. The boy has a big space in which to swing at full length; he dare not attempt the feat unless he had. Jimmy revolves in a comparatively small space. The length of the cage is not sufficient for him to go "all out," so to speak; as his flight brings him near the end of the cage he has to double up, so that, though his body is straight, his legs are drawn up under him. When the danger spot is passed he straightens himself out to full length. Round and round he swings, like a thing of whalebone.

Mansbridge makes not the faintest sign, but suddenly calls "Stop." The gibbon, by a splendid movement, comes to rest *instantly* on his bar, and sits there like a little silver statue. "Again!" calls his proud tutor; and once more Jimmy does his wonderful swing, and again pulls up at the word of command.

This was the last of the events in the private rooms of the ape-house, and we now come to the front of the cage in which the orang-utangs play. First, there is Sandy, who is full grown. He is sixteen years of age, it is believed, and has been at the Zoo since 1905, prior to which he was for seven years in a similar place at Singapore. In the cage next to him is a great, active orang named Jacob, who is eight years old, and has been since 1908 one of the Zoo aristocrats.

JACOB ORANG-UTANG, THE ARISTOCRAT EIGHT YEARS OLD

Of course, Mansbridge speaks with pride and affection of the orangs, but he says frankly that he does not encourage them to play any tricks with him. It is like trying to play a game at trains with a real locomotive engine for a toy. They are too tremendously strong for a human being to romp with. But Sandy does not think so. There is a second gangway at the back of the apes' cages, and along this Mansbridge walked, taking the apes their food. When he brought a pannikin of milk and rice to Sandy's cage and opened the door, Sandy at once leapt on to the open door, and swung himself to and fro in ecstasy. What did it matter to him that Mansbridge was offering him a bowl of food—was he not enjoying a swing on his very own gate? That was enough for Sandy, but not for Mansbridge.

"You great stupid, take your food!" said the keeper, pretending to be angry. Sandy did not mind; he went on dreamily swinging backwards and forwards.

"Take that, you rascal!" said Mansbridge, giving him a gentle box on the ears. Sandy thought that this was rather serious, so he got down, took his bowl of food, then, stepping up to Mansbridge, deliberately kissed him on the cheek as if to make friends. Fanny kisses Mansbridge also, as you will notice in the photograph, but to see this great ape standing erect and doing the same thing was a wonderful sight.

The ape is not taught to kiss; it kisses naturally. "Yes, it does seem strangely human," said Mansbridge when talking it over afterwards. "The ape is the only animal that kisses. A dog will lick your face, and sometimes a horse will; a cat rubs against you, but an ape kisses!"

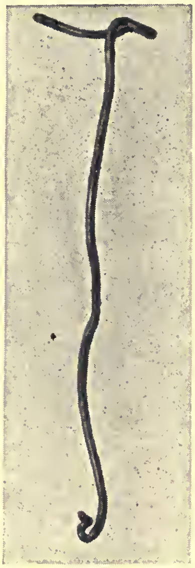
"Sandy has got an original mind, a better mind in one way than Jacob's," Mansbridge declares. "Sandy will think out some trick, but he does not improve upon it. He will always do it in the same way. Now, Jacob will watch him, copy his trick, then develop and better it. Sandy thought out a plan for getting water with a straw, and Jacob copied him, but, finding that he could get more water by using extra straws, he generally uses four. I will put some fresh straw in the two cages and you shall see what happens."

He put an armful of clean long straw in each cage, and the two orangs, each in his own house, set to work. They made the straw into a heap, and helped themselves to water. A trough of water is placed before each cage. Now, in the front of each cage two diamond-shaped holes have been cut, and bound round with thick wire to make them smooth. These holes are to enable Sandy and Jacob to put out their arms through the wirework front.

Sandy took a straw, popped the ear end of it through an armhole, dipped it into the trough of water which is on the opposite side of the gangway, drew it back to his mouth, and sucked the water from it. Jacob was more deliberate. Sitting on his heap, he drew out four long, straight straws, and put the ears into his mouth. Having got the ears of the straw in his mouth, he put the opposite ends through the left armhole in the wire. Next he put his right hand and arm through the right armhole, and reached across on the outside of the wire to the left armhole. Then he gently pulled the stalks until the ears were in turn drawn from his mouth, through the left armhole, and out into the gangway. Thus he had the stalks of the straw in his right hand, and all he had to do was to dip the ears into the trough of water, draw them back with his left hand, and drink.

He tried again, but got five long straws and some short ones. The short ones he threw away, but he drank from the five ears. Then he tried four straws again. Here, then, is evidence of intelligence. He first of all copies Sandy's trick. Instead of one straw he uses four, and with each dip gets four times the quantity of water that Sandy secures. The number of times that he chooses four suggests that, without any teaching, he must have learned to count up to four.

That is not his only trick. We always say that the apes are hopeless because they have never learned to use a tool. Well, Jacob *has* used one. Not long ago Mansbridge went in early one morning and found Jacob busily using a tool! An examination showed that Sandy had broken off a piece of the thick wire binding one of his armholes. He must have passed it through the bars of the partition to Jacob, for Jacob had got it when Mansbridge found him. With it he had made a tool. He had bent the wire across at the top so as to form a little handle, and the point he had used as a lever to unfasten the wire of one of *his* armholes. He had got off nearly all the wire binding when Mansbridge found him.


A TOOL MADE BY AN ORANG-UTANG

But Sandy is a terrible Turk. He used to have a long, thick iron chain in his cage, but he has not got it now. One morning Mansbridge heard a noise like distant thunder, and ran in, to find that Jacob had broken his steel chain. Instead of swinging on it, the young rascal had snapped it. He had carried up the broken chain to the top of the cage, he had passed the chain over the wire by which the cage is covered in, and with a piece of the chain in each hand he was sawing away as for dear life, trying to cut through or break away the wire.

Such are some of the events which make up the daily round of life in that great house at the Zoo where these strange likenesses of men are assembled. All that the apes do, except their feats of strength and agility, could be done by a small child. Still, the things they do could not be done by anything else on earth except a human being, and the thought makes us ponder deeply.

What do they think as they sit there, seemingly in a brown study? What, in their own form of language or method of communication, do they say to each other? What did Jacob say to Sandy, and Sandy to Jacob, when that broken piece of wire changed hands, to form, possibly, one of the first tools ever made by the hands of an untrained ape?

THE ANCIENT KING OF THE AIR MEETS AN INVADER

ABOUT TWO YEARS AGO AN EAGLE FLEW UP AGAINST AN AIRMAN, AND IT IS POSSIBLE THAT THIS EAGLE, THUS STRANGELY GREETING THE FLYING MAN, MAY HAVE BEEN ALIVE WHEN THE FIRST TRAINS RAN ON THE EARTH AND THE FIRST STEAMSHIPS SAILED AT SEA

CREEPING THROUGH THE CENTURIES

WHALES THAT PLOUGHED THE SEA BEFORE COLUMBUS AND THE TORTOISE THAT SAW NAPOLEON

THE OLD ANIMALS THAT LIVE ON WHILE MEN COME AND GO

A YEAR or two ago, as an aeroplane was flying across Europe, the new king of the air was met by the rival he had dethroned: an eagle flew with a scream of rage to attack the man who had dared to invade the silent realm where from the beginning of the world only these mighty birds had ventured.

What thoughts—if thoughts come to an eagle's mind—must have thrilled this dethroned monarch of the air. For it is possible that that same eagle may have witnessed all the great advances that men have made in means of travel; this bird may have been old enough to have witnessed the great procession of inventions which gave us ships and trains and aeroplanes as well.

It is possible that this eagle, wheeling in frenzied rage round the head of the cowering airman, may have stooped from the heights to scan the armies of Napoleon marching across Europe. It may have poised above the field of Waterloo when the fate of Europe was trembling in the balance; its cousin, the sea-eagle, alive today, may have looked down upon the battle of Trafalgar. A man in his life sees many changes, but his days are few compared with those of some of the lower animals.

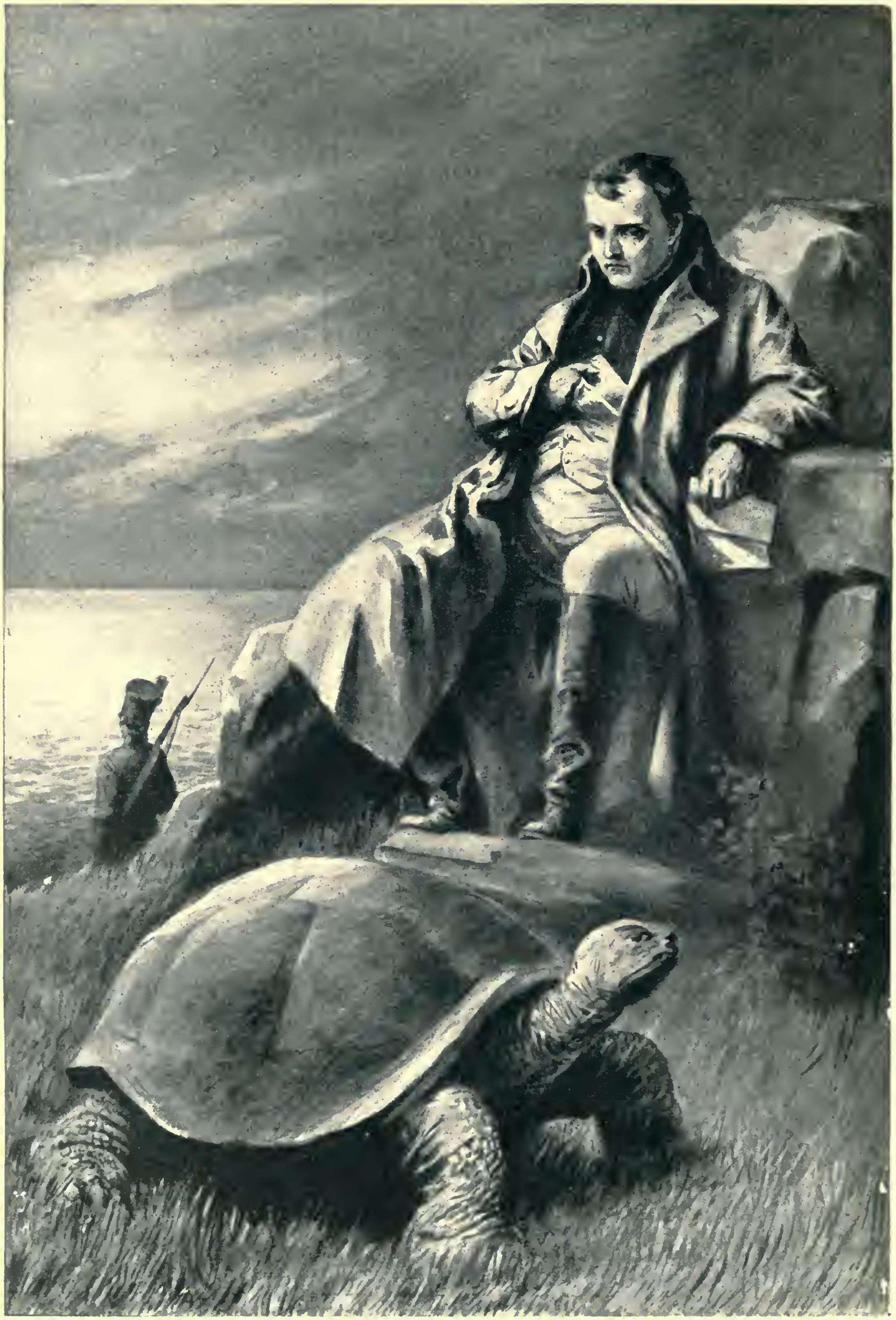
Once upon a time animal life did not die. Life consisted of one-celled forms. These cells divided, one becoming two, two becoming four, and so on, just as happens still in that lowly scale of living things which we call the one-celled animals. When life became more highly developed and complicated, it cast aside the one-cell system of organisation, and it paid for its better body with its life. In the animal world we find many types whose lives last longer than those of men.

It is difficult to account for the differences between the life-spans of various types of animals. Generally speaking the larger types live longer than the smaller. An elephant, for example, should live twenty times as long as a mouse, whose full course is run in six years; but then the donkey will outlive the biggest and healthiest horse, and an eagle may witness the death from old age of five generations of ostriches, whose span covers from thirty to thirty-five years. Bulk does, as a rule, last longer, for small animals and birds, in time of famine or great cold, have less power of resistance, less substance upon which to support life, and so are sooner chilled and frozen than the big, warm-blooded animal or bird. It is a mysterious subject, as fascinating as it is puzzling. Many learned men have studied it, and the records they have kept are astounding.

Men do not live long enough to count the years of the whale, but as trees tell their age by the rings of wood in their trunks, so the structure of the whale reveals the story of its age. There are still giant whales in the seas—fewer than there should be, but more than we knew of, as we were delighted to hear when the Shackleton expedition found an unknown species in the Antarctic Ocean; and it is not unlikely that there swims today a whale which was ploughing the ocean before Columbus. There may be whales alive which dived about the Spanish Armada. For, though there can be no certainty upon the point, it is believed that whales live for fully five hundred years. Not all whales, of course, can reach this age. Men have been hunting them for a thousand years, and they have deadly enemies in the waters; but the giants that survive may run out their five centuries, an age unapproached, so far as is known, by any other animal.

There has been no animal, save its own kind, to keep it company through life, for generation after generation has passed away and new forms have succeeded to old. But it is possible that if it had swum to tropical waters it might have seen, near the mouths of the great Indian rivers, crocodiles whose

THE GIANT TORTOISE THAT SAW NAPOLEON



THIS GIANT TORTOISE WAS CREEPING ABOUT ST. HELENA WHEN NAPOLEON WAS FIGHTING AT WATERLOO; IT WAS AN OLD, OLD TORTOISE THEN; IT SAW NAPOLEON IN HIS EXILE; IT LIVED ON AFTER HIS DEATH AND HIS BURIAL IN PARIS. IT CREEPS ABOUT IN HIS FOOTSTEPS STILL.

days have extended over the centuries. We cannot put a positive limit in our calculations of the age a crocodile may reach. It may be snapped up by a stork the moment it leaves the shell; it may be swallowed by a hungry fish as soon as it enters the water. If it escapes it may have little ones of its own when it is about ten years old. But then, all being well, for a full hundred years it will continue to grow; naturalists dare not trust themselves to say how long the growth may go on. But crocodiles are believed, after a careful study of all the evidence that can be collected, to live for three hundred years, and all that time to keep on growing.

THE LIVING LINK WITH THE FAR-OFF DAYS WHEN REPTILES RULED THE EARTH

That is not without parallel in Nature, for the whale, among other animals, continues to grow as long as it lives, but it is not common. Men cease to grow after a certain time, so do horses, elephants, dogs, cats, and the majority of animals. But the crocodile continues to increase in girth and length until the time comes for him to die, and it is because he lives so long that naturalists shrink from saying how long he may carry on the art of growing. It is these very old crocodiles which are so feared by man. They do not all attack a man at first sight; some even slink away from us, as most lions and tigers do. But the old ones, like those animals, come in time to learn that men are but feeble—and quite pleasant to eat! No doubt it is these monsters, with the growth of centuries in them, that attack, not only men, but camels, horses, cattle, and even the hippopotamus.

Crocodiles are terrible things, but they are as fascinating as they are dreadful. They remain to us a link with the marvellous nightmare times when reptiles ruled the earth, when the living creatures of the earth were as much bigger than the present-day crocodile as the present-day crocodile is bigger than the lizard.

THE LITTLE GOLDFISH THAT MAY LIVE LONGER THAN ANY MAN HAS LIVED

The long life of the crocodile suggests this thought—that the mighty monsters of those awful days, some eighty feet long and forty feet high, must have lived for hundreds of years, longer than the whale lives now. They may have lived as long as some of the trees of our forests, and some of these live more than a thousand years.

The whale stands first, then, as a living link with the past, and reptiles and birds—such as the eagle and the raven, which may live perhaps two centuries—would seem to come next. But perhaps they do not. Not only reptiles, but fishes of certain kinds run a close race for the prize. The little goldfish we see swimming in bowls do not suggest the possibility of age. Many people would declare them very short-lived, but if these fish are short-lived it is because they are not properly fed. Fish that soon die in bowls, die either of starvation or from lack of proper water supply—a horrible thought which those of us who keep pets should always have in mind. Goldfish are carp, members of a family of fish renowned for their great age, and it is certain that they can live as long as the elephant, living and flourishing for two hundred years and more.

We reach here one of the seeming contradictions of nature. It is safe to lay down a sort of rule for our own guidance, that animals which live a very long time multiply slowly. That is so with the eagle and the elephant. Elephants do not become parents until they are about thirty years old; eagles are fully ten years old before they rear their first nestlings. But the carp, which in fortunate circumstances lives at least two centuries, may, in the course of a season, lay eggs weighing a third of its own weight.

CARP THAT STILL SWIM IN THE POND WHERE MARIE ANTOINETTE FED THEM

See what this means. One female carp, weighing 16½ pounds, was found to contain eggs numbering over two millions and weighing 5½ pounds. How are we to reconcile these tremendous figures with the law that, taking one season with another, the number of animals of a given species remains the same? It means that the eggs of the carp are preyed upon to such an extent by other fishes, by water beetles, by birds, and by the many enemies of fish life, that, but for its great number of eggs, carp would become extinct.

But the point we are concerned with now is the almost incredible duration of their lives. If we are to believe history, there are carp, handsome and dainty, swimming in the beautiful waters of a garden at Versailles, which Marie Antoinette used to feed in her happy days before the French Revolution. The beautiful Queen of France, as often as she could, forsook the stately splendours of the royal palace for the modest comfort of a little house near by; and here, with her chosen friends, in simple raiment and without ceremony, she shut herself off from the pomp and formality of

MARIE ANTOINETTE FEEDING FISHES STILL ALIVE

IT IS SAID THAT THE FISH STILL SWIMMING IN A POND AT VERSAILLES ARE THE FISH FED BY MARIE ANTOINETTE IN THE HAPPY DAYS BEFORE THE FRENCH REVOLUTION the Court, and, roaming wild and free in the great park, fed the singing birds, the skipping squirrels, and the carp in the pond.

Marie Antoinette has now been in her grave over 120 years, but it is said that the carp still in the pond are the carp she fed; and some of our readers may have fed them too. If we are to believe the story of these carp, they were placed in the pond at Versailles during the reign of Louis XIV., who was born in 1638 and died in 1715. It is a moving thing, as we stand on the bank of the pond and watch the squirrels popping up and down the trees under which the poor queen used to rest, to watch the great fish in the pond, and realise that they were once fed by the hands of this ill-fated lady.

THE GIANT CARP OF HAMPTON COURT, WHICH A KING TOUCHED 200 YEARS AGO

From this beautiful scene she was taken, to be carried on a rough plank in a common cart, through yelling mobs, to the scaffold. The hands from which these fish received their food were tied with rope and held by the executioner, and the body of the queen was thrown into a pit of quicklime, in which it vanished for ever; but these creatures of the waters still live on, as happy as if the French Revolution had never been. There are in England carp which are perhaps as old. Eight years ago men employed to clean out the famous Long Water at Hampton Court netted a giant carp said to have been placed in the water by King George I., who died close upon two centuries ago. The size of this carp led the experts to declare that it was one of the fish caught, taken out, and restored to its old place when the Long Water was cleared out last century but one.

THE GIANT THAT LIVED ON ST. HELENA WITH NAPOLEON, AND IS STILL ALIVE

There may be living, as we have seen, fishes fed by a Queen of France before the Revolution; there lives, we know, a giant tortoise which Napoleon, the ruler of France after the Revolution, must have seen—perhaps he fed it during his exile after Waterloo. This is a reptile of a fast-disappearing type. Giant tortoises live sluggish lives, with few excitements. They eat vegetable food, they sleep through the winter in climates such as ours, they bury themselves in the ground during six months of the hottest part of the year in their tropical homes. There is no reason why they should soon wear out. They have their mighty bony armour to cover and defend them, and they have few enemies to fear except man. They formerly abounded in the Seychelle Islands, in Mauritius, and in the Galapagos Islands, and from their island homes they were taken, thousands of them, to be slaughtered for food, as the dodo and the solitaire were slaughtered. But there has always been someone, since the islands became frequented by man, with imagination to realise that these mailed monsters possessed an enormous interest for mankind, and that, once this race was disposed of, there could never again be a giant tortoise in the world.

They have vanished from most of their old haunts, but there are a few at Aldabra, in the Seychelle Islands, now under strict Government protection. Those who cared for the tortoises in the past sent fine specimens as presents to various parts of the world, and one was sent to St. Helena. It was there over a century ago; it is still there, alive, in the same old place today, stalking stolidly and slowly about where it stalked in the days when Napoleon, fallen from his greatness, was sent there by his conquerors. *It saw Napoleon.*

THE OLDEST INHABITANT OF THE BRITISH EMPIRE

How old that tortoise is we do not know; we do not know the ages of those which have gone to London to live in the Zoo. One which died not long ago was said to be from two hundred to four hundred years old. The largest one there, a monster weighing as much as seven men, and measuring over forty inches long in a straight line, is believed to be two hundred years old. Another monster lived for some time at Tring Park, after a career of one hundred and fifty years in the Chagos Islands. The great tortoise which died at the Zoo had lived since 1766 in Mauritius and was a giant when taken there. With it to Mauritius went four others, of which three were still living a few years ago, and may be thriving still. One of the five is a sort of imperial figure. Its home a century ago was in Port Louis, Mauritius, the island once called the Isle of France, for which Count la Pérouse set sail from Australia on the voyage that brought him to his death.

La Pérouse died in 1788, and his ships, stranded on a coral reef, have lately been rediscovered. These giant tortoises were living giants in those days, and La Pérouse might have seen them had his voyage been completed. The imperial figure, as it is called, is really the property of the British Empire. Its home is at Port Louis, and when Mauritius passed into the hands of Great Britain, early in the 19th century, the tortoise, as a gigantic curiosity, was specially mentioned in the property which went with the island; it was taken over with the island, a sort of living fixture, and it lives still and is still the colossal pet of the barracks there.

If these great creatures were already fully developed when they were carried by settlers and planters to new homes, more than a century ago, how great must have been their actual age! The story of these veteran giants is intensely interesting. They all arose in little islands. The Galapagos Islands actually take their name from them, "galapago" being simply the Spanish name for tortoise. Now, these tortoises, unlike the turtles, their neighbours and distant kinsmen, do not swim. Here they were, however, in these islands, shut off by deep seas from any other land, and they were not upon one island merely, but on distinct and widely separated islands, each island with its own peculiar species. How did they get there? And how did they become giants and centenarians?

The answer is that they achieved this distinction by the same means as those which enabled the extraordinary animals of Australia to assume their strange form. The animals of Australia are the descendants of the strange beasts which roamed the earth when Australia was connected by land with South America They were shut off from enemies and from the influence of the animals which throughout the rest of the world were changing their form. The ancestors of these tortoises reached the islands when these little tracts of land were all one and formed part of a continent, and when the land joining the islands with a continent sank beneath the sea the tortoises became happy prisoners, each type in its own island domain. They had no enemies to vex or harry them. They had abundant food, and the ample leisure that a tortoise loves; they had only to eat and grow fat and live long, and to grow big and fat became the *habit* of the order. In this way each island gradually became possessed of its own distinct species.

THE GIANT TORTOISE OF MAURITIUS, THE OLDEST INHABITANT OF THE BRITISH EMPIRE

There is a tendency in Nature for like to succeed to like, and as one generation of giant tortoises varied a little from its parent generation, so each succeeding generation carried on the scheme of variation.

So after the whale we must place the reptiles and the fishes, and after these the birds. Which bird really lives longest we do not know. All ancient and modern research places the raven high up the list, and common agreement fixes its lease of life at a possible two hundred years. Then come the great birds of prey, the eagles and vultures. It is known that an eagle-owl lived ninety years in captivity, and that after fifty years it began to lay eggs, and brought up little ones for the last forty years of its life Parrots, again, live to great ages, and there is a case on record of one beginning its nesting duties after being thirty years in captivity. A century is not an excessive estimate for the life of this bird, and experience shows that with good fortune both the crow and the swan may attain the same number of years. That serves to remind us that it is not always the biggest bird which lives longest. We have surprising confirmation of this in a table drawn up some years ago, showing the age which birds may reach

	Years		Years		Years
Thrush	10	Lark	18	Peacock	30
Hen	10	Nightingale	18	Sparrow	40
Robin	12	Pigeon	20	Goose	50
Goldfinch	15	Linnet	23	Pelican	50
Partridge	15	Canary	24	Parrot	50
Pheasant	15	Crane	24	Heron	60

Not all these figures agree with others that have become available since this table was drawn up by Mr. Mulhall, the famous statistician, but we may take it that each total refers to a known case. Now let us see what results his examination of evidence gave him as to the years through which animals that escape misfortune may attain. He gives us these figures as to the patriarchs: whales, 500 years; alligators, 300 years; elephants, 100 years.

But let us glance at his table of ages for animals large and small. Here again we have examples of animal life-stories which have been tested, but there is this important fact to be remembered—that, whereas a lion seems to have an advantage over the domestic cow, the cow is not allowed to live out its full life. Its period of usefulness to man passes away, and it is put to death. The same remark applies to the sheep, the pig, the ox, and, indeed, to all the animals which serve us as food. None of them would reach the century, but they would all live longer if we allowed them to do so. It is interesting and valuable to consider size with years, for our rule is, we have agreed, that the small animals die sooner than the large ones. The following figures show the weight of the animal and its length of life.

Rabbit	5 pounds	5 years
Dog	40 ,,	15 ,,
Sheep	[illegible]0 ,,	12 ,,
Pig	160 ,,	10 ,,
Lion	500 ,,	40 ,,
Cow	750 ,,	25 ,,
Ox	900 ,,	25 ,,
Horse	1000 ,,	27 ,,
Camel	1200 ,,	40 ,,
Elephant	6000 ,,	100 ,,

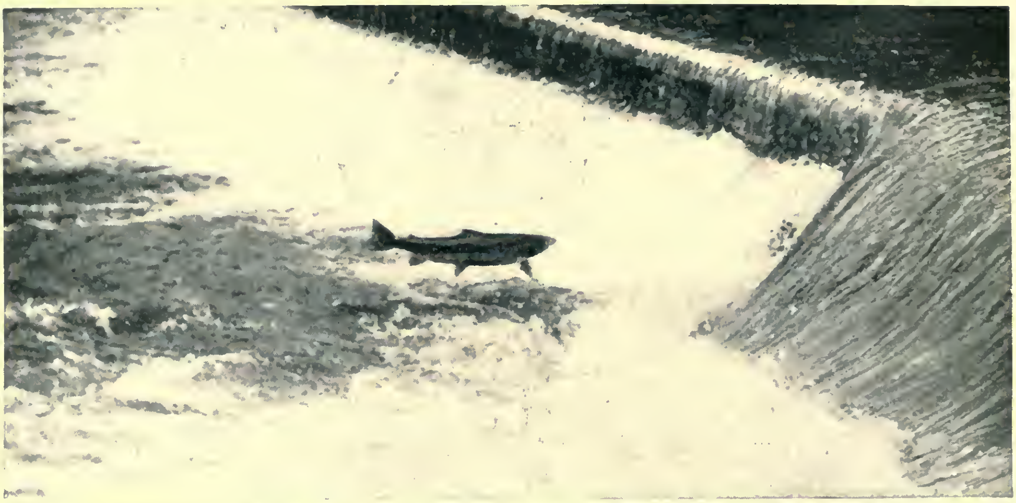
The ages of some animals are wonderful enough to stir the sleepiest imagination. There may be crocodiles alive in India which were there soon after the first English traveller set foot in the land; there may be eagles living which saw Moscow as Napoleon's army marched through its streets; there may be whales still swimming in the sea which roamed the waters a hundred years before the British Empire began, before our forefathers ever set foot on this mighty continent, and Indians roamed and hunted through dense forests that have disappeared and are almost forgotten.

If an ancient whale could speak, what a tale he would have to tell of the days that he has lived and roamed the seas! Perhaps he saw Columbus set out on his first perilous voyage, or watched the little ships that crept across the seas, carrying at most a hundred or two hundred souls, to make the small beginning of a mighty nation. He may have seen the first ocean steamship as she threshed her way across the ocean billows, or wondered as the mysterious cable rolled down the sides of the Great Eastern and dropped into the silent depths below.

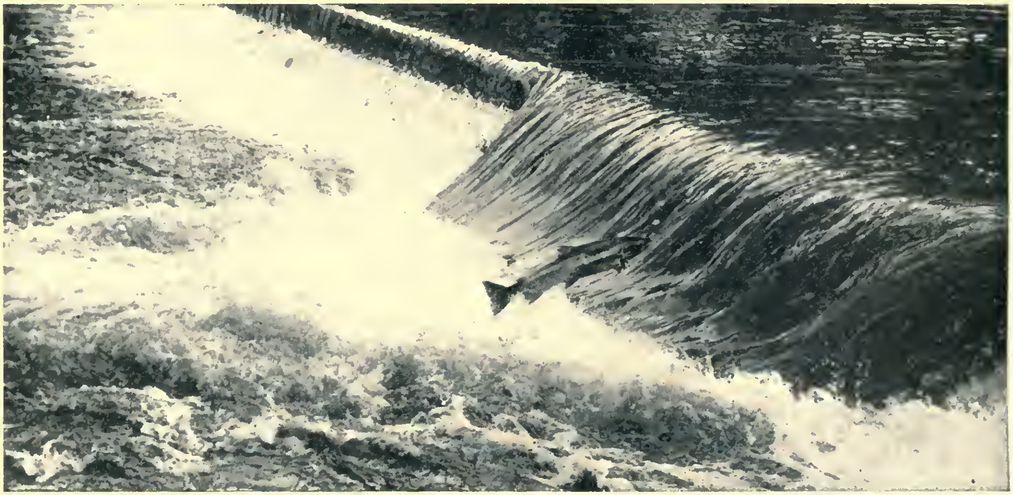
Think of it! Five hundred years of swimming to and fro, and up and down, while the first frail ships gave way to larger ones, and sailing-boats to giant steamships, and many of these in their turn have had their day, and have mouldered and decayed. In these long centuries generations of men have lived and worked and died; great nations have lost their place in the world, and others have been born. The whale that saw the wreck of Gilbert Humphrey's gallant little vessel might have hung close by as the giant Titanic slid from the berg that crushed her and was swallowed up, with its living freight, in the icy, lonely waves of the Atlantic.

So old these things may be, born in a sea that Columbus had not yet sailed on, born in a world that no man yet had travelled round, and whose wonders were as yet unknown. The vast continent of America had not yet been discovered, the Pacific was still unknown, Australia was not even the shadow of a dream. It is a strange and stirring thought; and our imagination staggers at the idea of what may happen in earth and air and sea when the little whales now growing up are nearing their old age, or even when the baby eagle is lying down for its last sleep.

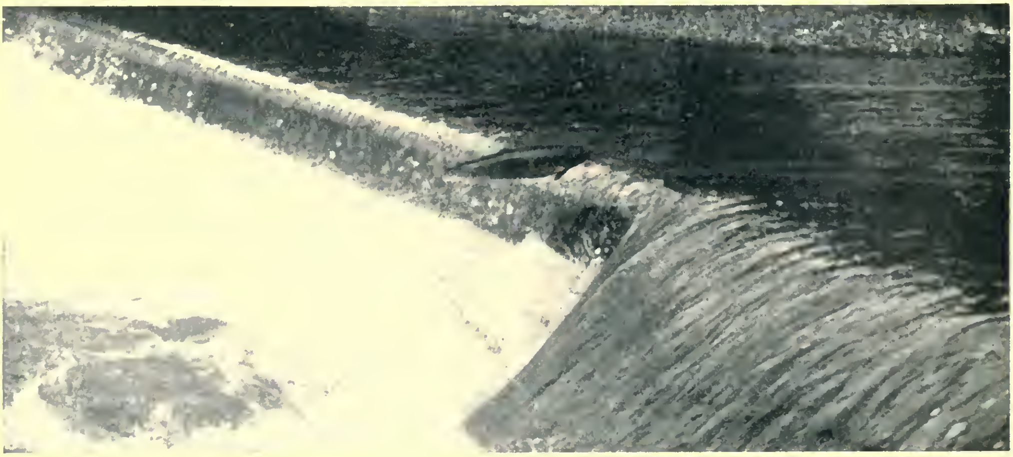
THE LEAP OF THE SALMON AT THE WEIR



THE SALMON, BORN IN A RIVER BUT GOING EARLY TO SEA, LONGS AT LAST FOR THE RIVER AGAIN



HE WILL SWIM AGAINST THE STREAM AND WILL LEAP OVER ROCKS AND BARRIERS IN HIS WAY



THE SALMON'S LEAP AT THE WEIR IS ONE OF THE WONDERFUL SIGHTS OF NATURAL LIFE

THE RAT, BAT, AND LOBSTER SCHOOL

THE GREATEST SCHOOL IN THE WORLD, IN WHICH ALL MEN ARE LEARNERS AND ALL LIVING THINGS ARE TEACHERS

WHAT AN ENGINEER LEARNED FROM A LOBSTER'S TAIL

THERE is a school in which even rats and bats and lobsters teach, and in which the wisest men in the world are learners. It is the school of Nature.

If there is one thing upon which man prides himself, it is his wonderful inventive genius, his power of discovering and applying mechanical principles and making them serve his purposes. It is in this that he considers himself so far above the lower animals ; it is here that he regards himself as the pioneer and master. And yet in almost everything Nature has been before us and shown us the way. Nature is an open book, in which all wise men read their lessons.

Patiently and laboriously man has worked through the centuries discovering and perfecting some machine or operation that should add to the convenience of life, and then, afterwards, he has found that his dearly earned invention is nothing more than a device which Dame Nature has known and used for thousands, and possibly for millions, of years.

On water, man has his ships and boats driven by paddle or screw or oar ; on land he has his tools for digging, his system of tillage and drainage ; in the workshop he has his saws and shears and chisels and planes and pincers and hammers ; in architecture he has his towers and spires and domes and arches and buttresses and doors and hinges ; in the home he has his scissors and nutcrackers and brushes and combs and fans ; in warfare and hunting he has clubs and swords and armour and pitfalls and trenches and forts and disguises. All these and a thousand other things are simply conscious or unconscious imitations of the works and devices of Nature, which are older than the oldest men.

In some cases clever men have seen Nature at work, and, by following her methods, have achieved success. Perhaps the most remarkable instance of this was the building of the third Eddystone Lighthouse. Two lighthouses had previously been erected on the terrible rock that looks out on the wild Atlantic, and both had been destroyed—one by storm and the other by fire. Then John Smeaton, a distinguished civil engineer, was asked to build a lighthouse, and he undertook the work. Strength to resist the wind and waves was needed, and Smeaton felt that the nearer he could get to Nature's methods the greater would be his success, and after much thought and consideration he decided to take a tree as his model, and to make his lighthouse the same shape as the trunk—wide at the base and tapering towards the top. Further, he determined to build the foundations into the rock very much in the same way as the roots of a tree spread out into the soil.

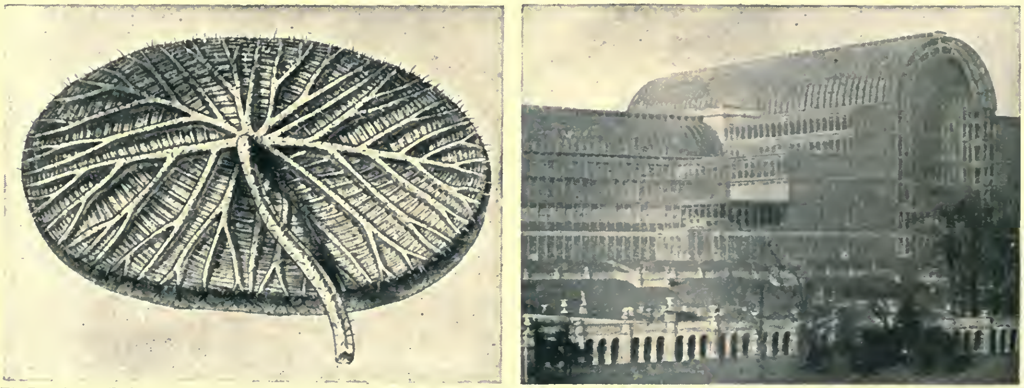
In all this Smeaton was consciously following Nature, imitating the things that he had seen and studied. But in another very important detail of his plan he unconsciously followed the methods of Nature. Instead of building up the walls of his lighthouse like the walls of an ordinary dwelling or church, he decided to dovetail the great blocks of stone together, so that, by making the lighthouse to all intents and purposes one huge stone, he should add greatly to its strength.

This was a really brilliant and clever device, but, although at the time Smeaton did not know it, he was only doing what Nature had already done, in building a house for her most wonderful product, the human brain. The skull must be exceedingly strong to protect the brain, and the various bones that make up the skull and meet together on top are marvellously dovetailed, so that they form what may practically be regarded as one great, dome-shaped bone.

How unerring Nature is in her mighty work may be gathered from the fact that Smeaton, having by a happy combination of imitation and intuition followed the methods and plans of Nature, has himself been followed ever since by the builders of lighthouses. No more durable design for a tall, narrow building that is to resist the fury of wind and wave can be conceived than that of the tree built up of dovetailed sections, and rooted firmly in the rock. Smeaton's design is still imitated by builders of lighthouses all over the world.

A BUTTRESSED TREE-TRUNK WHICH PROBABLY SUGGESTED CHURCH BUTTRESSES

Another well-known instance of Nature teaching the architect in England resulted in the building of the Crystal Palace. Joseph Paxton, the gardener to the Duke of Devonshire, had noticed the wonderful strength of the leaf of the immense Victoria Regia lily, and, examining it under the microscope, he saw the ingenious plan of its structure. Thereupon, he drew up plans for a great building to be erected on the same principle, which was, indeed, the only possible form of construction for a huge palace that was to be practically all window.

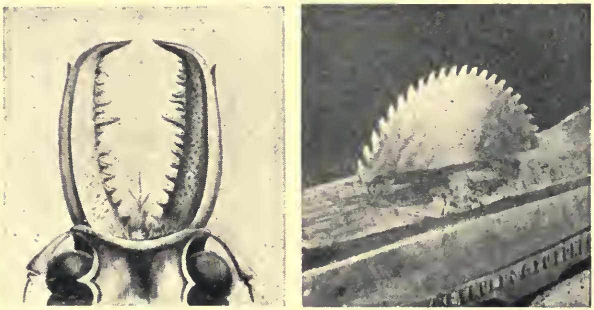

THE MARVELLOUS FRAMEWORK OF A VICTORIA REGIA LILY LEAF, AND THE FRAMEWORK OF THE CRYSTAL PALACE, WHICH WAS BASED UPON IT

HOW THE FOOT OF THE MOLE RESEMBLES A MINER'S SHOVEL

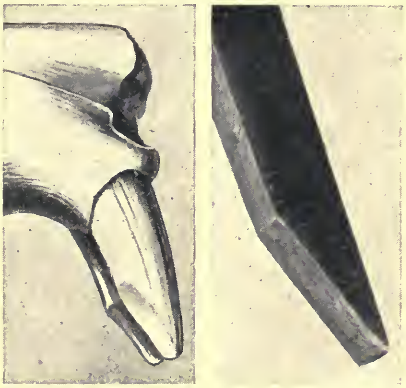
Nature is always wonderful in obtaining the greatest results from the least expenditure of energy and material, and man always triumphs when he either sees and copies her, or lights by accident or long study upon her methods. When the Northern nations became civilised, and began to erect churches and other imposing buildings, it was necessary that some plan of architecture should be devised that should give greater opportunities for windows in lands where the sun did not shine so regularly and so powerfully as in Greece and Rome, and gradually Gothic architecture was evolved, with its slender, towering walls. These needed some support, and so the buttress was developed which we see outside all the Gothic churches and cathedrals.

But the buttress had long before been anticipated by Nature, and perhaps the most notable example of it is seen in the paddle-wood tree of South America. This tree, which has a tall, slender trunk, has to resist fierce storms from many quarters, and so, as it grows, it throws out buttresses all round, which give it a strength and resistance altogether beyond its actual girth and bulk. The buttresses are so thin and even that the natives cut them away from the tree and use them as planks without any further preparation.

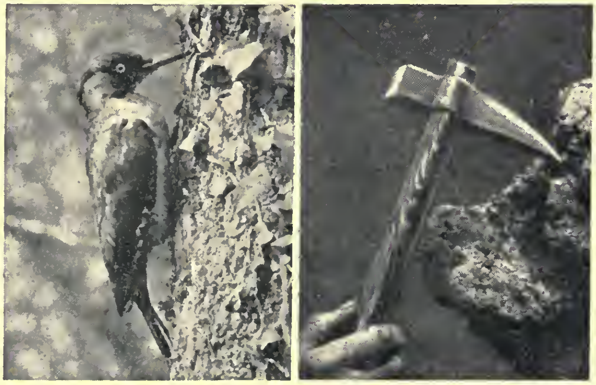
No matter what style of architecture we look at, Greek or Roman, Gothic or Oriental, we find all its main features anticipated, and that by such humble and minute creatures as the radiolarians. Myriads of these little animals die every moment in the Pacific Ocean, and they are so minute that eight millions of them could easily be packed into the space of a single cubic inch. Yet we find among their shells perfect specimens of the pyramid, arch, dome, spire, minaret, pagoda, column, and, in fact, every architectural form of every age.


HOW THE IDEA OF THE CIRCULAR SAW IS SEEN IN THE JAWS OF THE SAWYER BEETLE

The civil engineer, too, can find all his best plans anticipated in Nature. One of the most striking and useful engineering works of modern times is the storing up of large reserves of water for man's use, by means of great dams built across rivers or lakes. But the wonderful Nile dam and all the other great works of a similar character are really constructed on the same plan as that which the beaver has followed for thousands of years.


THE CUTTING-TOOTH OF A SQUIRREL AND THE BLADE OF A CARPENTER'S CHISEL

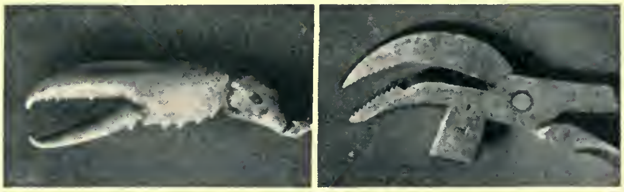
In tunnelling and sinking shafts the engineer can learn much from Nature's little workers, for there are many birds and beasts, fishes and insects, that are very skilful at digging passages underground. Perhaps the most interesting of these is the trap-door spider, which digs a circular shaft, carrying all the excavated earth some distance away, and shoring up the walls with silk as it digs, to prevent them falling in on her. She then makes a little door with a bevelled edge which fits beautifully into the shaft, which is also bevelled to receive it. When the door is closed it is exactly level with the ground, so that no creature, however small, can pass inside. The door is skillfully hinged with silk, and so strong is the workmanship that it may be opened and shut hundreds of times without appearing any the worse for wear.


A WOODPECKER AT WORK WITH ITS BILL, SUGGESTING THE PRINCIPLE OF A SMALL PICKAXE

When the trap-door spider fears an enemy she closes the door of her home, and, pressing her claws into tiny holes on the under side of the door, she hangs upon it with all her might to prevent it from being raised from outside. If we are clever enough to discover the door and manage to open it for a moment, directly we release our hold the door is smartly slammed to again by the spider.

There are other creatures that protect themselves from sun and rain, not by a trap-door, but by a thatched roof. The sociable weaver-birds of South Africa build their nests close together, and then cover the whole colony with a conical or pyramidal roof made of grass in much the same way as we thatch our cottages. M. du Chaillu, the great French explorer who discovered the gorilla, found in Central Africa an ape which makes a roof to protect itself from the weather. It first constructs a framework of branches tied together and to the tree by pieces of creeper, and then on this framework it arranges leaves until the whole roof is the shape of an unbrella. The ape then rests on a bough under the covering.

Coming to tools, we find practically every invention of man forestalled. The claws of animals, like the mole, that burrow underground are really perfect little spades made on the same plan as our miner's shovel with its pointed blade. The forefeet, too, of the mole-cricket, a little insect noted for its digging habits, are wonderfully well-formed shovels.



A LOBSTER'S CLAW AND A SHOEMAKER'S PINCERS

All our cutting instruments—knives, razors, and so on—are really saws, for no matter how finely a man may grind the edge of a knife or razor, that edge, when seen under the microscope, at once has the appearance of a saw with teeth. We find many instances of the saw in Nature, but perhaps the best is that of the saw-fly, which has a pair of wonderful little saws. With these it cuts grooves on the bark of trees, and there deposits its eggs. The teeth of these living saws are very elaborately formed, for each tooth has itself a series of teeth on it; and it has been suggested that if tool-makers were to examine these saws carefully under a microscope, and imitate them exactly in steel, they would greatly surpass the tools now used by our workmen.

THE PINCERS OF AN EARWIG AND A PAIR OF COMMON PINCERS

Even the circular saw, so much used for rapid work today, is not new, for the sawyer beetle of South America has used the principle for thousands of years. It has deeply toothed, curved jaws, and, seizing a branch as thick as a walking-stick between these, it flies round and round rapidly, transforming itself for the time being into a circular saw, until before very long the branch is severed and falls to the ground.

HOW THE PRINCIPLE OF A GIMLET WORKS IN THE OVIPOSITOR OF A GIANT-TAILED WASP

We probably know that the beaver's teeth are shaped like a chisel-blade. The resemblance, indeed, is not merely one of shape, for the very construction of the teeth is like that of some chisels. The blade of the carpenter's tool is often not made entirely of steel, but is of soft iron with a thin sheet of steel at the back. In use the soft iron gets worn away more quickly than the steel, and so the chisel keeps a sharper edge than it would otherwise do. Exactly the same kind of thing exists in the teeth of the beaver and other rodents, or gnawing animals. The outer surface is a plate of hard enamel, while the rest of the tooth is of softer material; and so in use the softer part is worn away more easily than the enamel, and thus a sharp edge is constantly preserved. Perhaps it would be more correct to say that the teeth of most of the rodents are like an adze rather than a chisel—this is particularly true in the case of the hippopotamus.

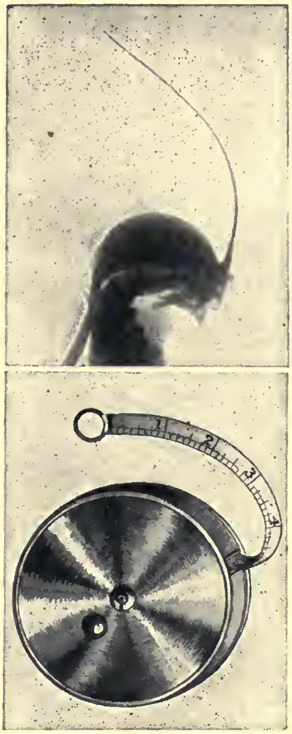
The pickaxe, in which the whole tool is swung, so as to lend force to the blow of the point, is not an original invention of man, for birds like the nuthatch and woodpecker are really living pickaxes. Grasping firmly with his claws the tree on which he is at work, the bird swings his whole body backwards and forwards, and is thus able to bring his sharp beak down with great force on the wood of the tree. A naturalist who captured an ivory-billed woodpecker left the bird, which was wounded, locked up in a room. When he returned he found that it had made a hole in the plaster wall, about fifteen inches square, and, if left alone, would before very long have managed to escape. He then tied a string round the bird's leg, and, fastening it to a large mahogany table, again left it for a short time. On returning, the man found that the woodpecker had been busily at work, and had almost ruined the table. Such is the power of the bird's beak when used as a pickaxe.

Many perfect examples of pincers are found in Nature. Those of the earwig are well known, and their resemblance to an ordinary pair of carpenter's pincers is so exact, both arms working together, that it is not necessary to describe them. In the lobster's claw we have another kind of pincers, remarkably like those used by shoemakers.

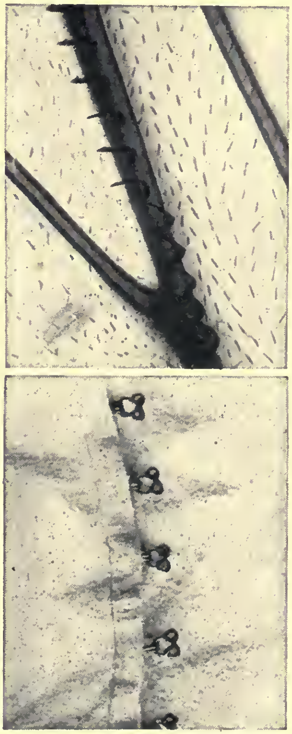
A very important principle which is applied in all kinds of tools is that of the wedge. We find it in the knife, nail, pin, needle, axe, and so on. Nature, too, makes good use of the wedge. Almost wherever we look we see it in evidence, for grass-blades are simply little wedges that have, by reason of their shape, and despite their tender nature, been able to force their way up through the hard soil, in exactly the same way as an iron wedge splits a log of wood.

We all know the curious angler-fish, which dangles a kind of fishing-rod in front of its mouth to entice little fish within reach. This fishing-rod is really a bone which is fixed to the creature's head, and in order that it may be moved in every direction it is attached to the head by an arrangement like a ring and staple. That device for chaining up a ship or a dog, and for many other purposes, is a very old but very clever invention of man, but Nature had used it long before man ever lived on the earth.

The ovipositors of many insects—that is, the instruments with which they put their eggs in suitable places—are very wonderful, and closely resemble human tools. That of the sirex, or giant-tailed wasp, which is not really a wasp at all, though it looks like one, is an excellent gimlet or centre-bit. In its larval, or caterpillar, stage, the sirex feeds upon the wood of the fir-tree, and it is necessary, therefore, that when it is hatched from the egg it should be in such surroundings as will insure it a plentiful supply of suitable food. The sirex is armed with an ovipositor which many people think is a sting, and a very formidable one, but it is really a beautifully made boring instrument. The end of it has long, sharp teeth, curved slightly inwards like a carpenter's centre-bit, and then all up the shaft of the borer are hard, sharp-edged ridges running diagonally across it, so that when the sirex is at work it bores a perfectly clean, round hole in which to lay its eggs.



THE IDEA OF A SPRING MEASURE SEEN IN A GALL-FLY



HOOKS AND EYES—A BEE'S WING AND A GIRLS' DRESS

The ovipositor of the gad-fly, too, is a splendid boring instrument. The irregular, scoop-shaped end has five little hardened points, very sharp, so that it is identical in shape and character with the diamond drill of the miner. Further, it consists of four tubes of different sizes which fit into one another, and the ovipositor can thus be closed up, when not in use, like an ordinary telescope.

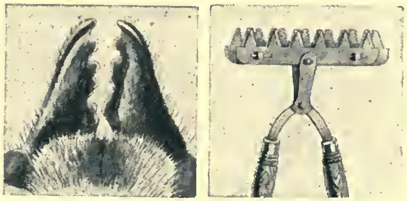
Another wonderful ovipositor is that of the grasshopper, which lays her eggs in the same way as a farmer's seed-drill sows the seed. The grasshopper's ovipositor consists of two blades; and when she has selected a suitable piece of soft ground in which to lay her eggs, she bores a hole, then separates the blades slightly and drops an egg, just as the seed-drilling machine drops the seed after boring a hole for it.

The spring measure that rolls itself up in a small case when not in use has its forerunner in another of the insect ovipositors—that of the gall-fly. This creature needs a very long ovipositor for its purpose; and as the instrument could not be carried straight, it is kept coiled up like a tape measure, and can be rolled or unrolled at pleasure.

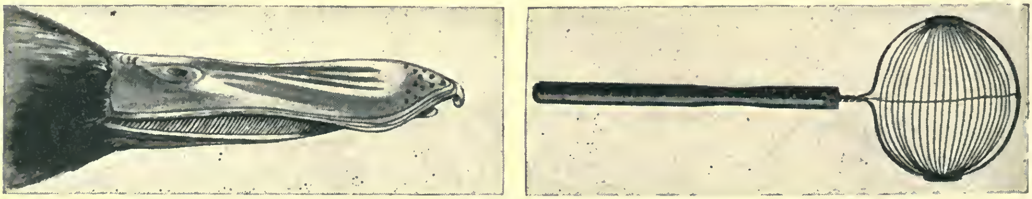
THE IDEA OF A BRUSH AND COMB IN NATURE—ON THE LEFT IS THE COMB-LIKE BILL OF A TOUCAN AND ON THE RIGHT THE BRUSH AND COMB ON A SPIDER'S FOOT

Many creatures carry scissors, and perhaps the most interesting of these is the leaf-cutter bee, which burrows into a tree or the ground, and then lines the burrow with pieces of leaf, which it cuts out with its jaws in exactly the same way as we cut out cloth or paper with a pair of scissors.

The bee cannot sew as well as cut out, but the tailor-bird of India is a skilful needlewoman. She builds her nest in a bag made out of two or more leaves, which she sews together with as much skill as many a girl can show. Sometimes she uses cotton-fibre, and at other times wool or silk from a cocoon. Her method of sewing is very much like that of the shoemaker, for she makes a neat hole with her beak, and then passes the thread through, having first tied a knot in the end to prevent it from slipping right through.


THE JAWS OF A LEAF-CUTTER BEE AND A PAIR OF HEDGE-CLIPPERS

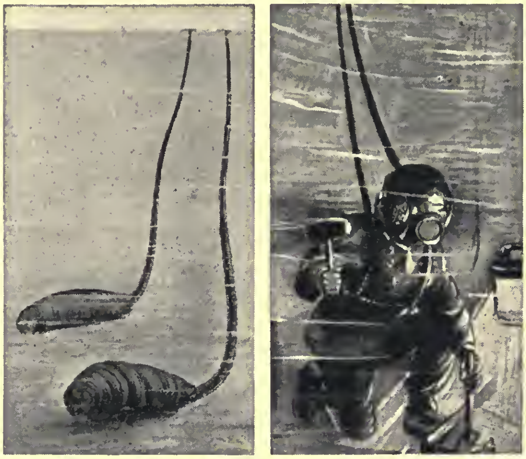
Although we may not find buttons in Nature, we find hooks and eyes. Insects like bees and wasps have four transparent wings, and these can be easily distinguished when the creature is at rest. But when it flies the four wings become two. The lower edge of the first pair of wings has a fold, and into this a row of beautifully formed hooks fasten on the upper edge of the second pair of wings, joining the wings together.


HOW THE BILL OF THE SHOVELLER DUCK SUGGESTS THE COMMON DOMESTIC STRAINER

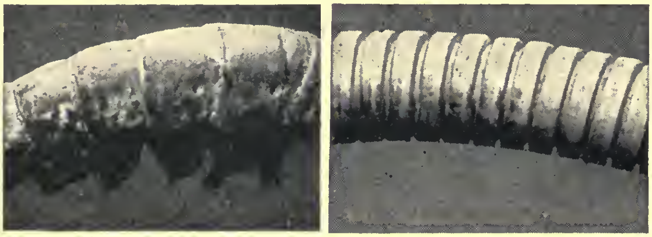
Combs and brushes are found over and over again. The foot of the garden spider is provided with both, which enable it to clear its body of any gossamer or web that may cling to it. Another instance of the comb is seen in the great bill, or beak, of the toucan, which is more or less notched with teeth, enabling it to comb its feathers and wear that smart appearance which seems to make it the dandy of the bird tribe.

A filter is a very useful article in every household, and so it is in the life of many creatures. The idea of a filter is, of course, to have a layer of porous material through which water can pass freely, but which will keep back any solid particles that may be there. Every whale has a filter in its jaw, made of baleen, or "whalebone." This is so arranged that, when the creature opens its great mouth and takes in water and fishes, the fishes are retained by the network of baleen, or "whalebone," while the water is filtered out rapidly. A somewhat similar arrangement for the same purpose exists in the beak of the duck. The respirator worn by the men who grind steel forks and other articles is really a filter. It is a gauze of magnetic wire fitted over the nose and mouth, which stops the tiny particles of steel that fly about in the air and would be breathed into the lungs, causing death. This is a very ingenious arrangement, but the respirator that insects have in their breathing apparatus is infinitely more wonderful.

Insects do not breathe through their mouths as we do, but have little air-tubes about their bodies, called spiracles, from a Latin word meaning "I breathe," and in the opening of these spiracles are tiny filters that prevent anything but air from entering.


HOW THE RAT-TAILED MAGGOT'S BREATHING TUBE SUGGESTS A DIVER'S AIR-TUBE

In the grinding of corn between millstones it is the practice to groove the surface of the stones, as much more rapid and efficient grinding results than when the stones are left smooth. This grooving was considered a great improvement when it was invented; but Nature has had her grinders constructed on this plan from time immemorial, and the best example is seen in the grinding teeth of the elephant. These are very large, and are grooved like millstones. They are exceedingly interesting, for, instead of being made of one solid piece of enamel, each tooth consists of several plates of hard enamel placed side by side, though not touching, and in between is a softer material, so that as the animal chews its food the enamel is not worn down so quickly as the softer layers in between, and thus the ridges are maintained.


HOW THE TAIL OF A LOBSTER GAVE AN ENGINEER THE IDEA OF A FLEXIBLE METAL PIPE

The science of diving and working under water has been greatly developed in recent years, but it has all been anticipated, and the principle of both the diving-bell and the diving-dress are seen in full use among the insects. The little water-spider breathes air like ourselves, and can be as easily drowned. Yet she spends most of her life under water, and this she can do because she makes a diving-bell for herself out of the silken thread that she produces.

But even more remarkable is the practice of the rat-tailed maggot, or larva of the drone-fly, that looks so much like a big bee. The creature passes its larval stage in the mud under the water, but it must breathe all the time if it is to live, and so it sends up to the surface a little elastic tube which can be lengthened or shortened according to need, and through this little tube the buried maggot breathes, just as the diver receives air through a tube from above.

This tube of the drone-fly larva is flexible, but a more interesting example of flexibility is the tail of the lobster, with its wonderful jointed armour, upon which the flexible pipes used in water-mains are based. An engineer named Watts had undertaken to lay a drain-pipe across the bed of a river which was very irregular. Realising that the pipe would have to adapt itself to the river-bed, he decided to make his pipe on the model of the lobster's tail, and this was so successful that the plan has been followed ever since.

But it is impossible even to mention a tenth of the instances in which man's inventions have been anticipated by Nature. The cricket makes its chirping noise by drawing its wing-cases across one another as we draw the bow across the violin strings; the broad snow-shoes which enable a man to walk across soft snow are made on the plan of a duck's webbed feet; the curved claws by which the bat suspends itself are like butchers' hooks. All these examples show us that man, while he may be the discoverer of new processes and mechanical devices, is really not the originator of these things. Consciously or unconsciously, he has followed in the path that Nature mapped out for him ages ago.

THE BIG COUSIN OF PUSSY-BY-THE-FIRE

THE LION AND TIGER ARE STILL FEARFUL CREATURES THAT NONE OF US WISH TO MEET, BUT THE CAT BELONGS TO THEIR FAMILY, AND IS A SORT OF TAME TIGER PLAYING WITH THE BABY ON THE HEARTH

THE TIGER ON THE HEARTH

THE DESCENDANT OF THE FIERCE WILD BEASTS OF
THE JUNGLE, SITTING AT OUR FEET BY THE FIRE

SOME WONDERFUL TALES OF CATS THAT SEEM TO THINK

YES, a tiger on the hearth, a tiger which fights and kills and devours as does the tiger of Bengal. Most of us have a tiger on the hearth, in the form of the domestic cat. For all its sleek coat and its velvety smoothness, for all its playful winning ways, the cat is a tiger at heart. Lions and tigers and leopards and jaguars and pumas are simply big cats, only they have not been tamed. The ancestors of the wild cats of Egypt and India and Europe were the ancestors also of the cats which now dwell with mankind, and thousands of years of association with the homes of men have not made their descendants quite free from the old wild instinct, the dauntless determination not to be completely subject to the lord of creation.

The dog is a roystering clown, who will play and romp for us, work for us, and die for us; the cat is always the distinguished guest, a guest of tyrannical habits, claiming the best cushion, ready to be amused, ready to interest and amuse itself at our expense, picking and choosing its friends with care, and resenting strangers. It demands more liberty than the dog; it must come and go when it wills; it declines to have knowledge thrust upon it, neglecting to learn easy things, but voluntarily mastering difficult ones. And from some pastime in the house, from light and graceful play with a child, or rougher romps with a grown-up, the cat will dart away at the pipe of a bird, to kill the little singer. Not because it hungers, not because it desires to eat the bird, but because in the nature of all cats is a deep abiding passion for cruelty.

The cat plays with a mouse with cruel savagery, patting it, pressing it, tossing it into the air and catching it again in its paws. When the little thing is swooning or exhausted with terror, the cat will carefully take it up in its mouth, administer a sharp bite to awaken it, then let it go again. That is exactly what a lion or tiger does with a man. A tiger will toss a man about from paw to paw, and bite him afresh as he falls. A lion, after carrying its victim away in its jaws, will lie down, either across his body or some little distance from him, biting and clawing him each time he moves.

Watch a cat bounding after a dried leaf flying across the lawn before an autumn wind, and you see the tiger; the same headlong dash, the same outspreading talons, the same fierce mouth at work. The same exquisite grace and activity which the cat reveals in playing on the hearthrug with a ball of wool is reproduced when it chases a bird or a mouse or a rat. When it catches the mouse it does eventually eat it; when it catches the bird it does not eat it if the bird be fully feathered, but tortures it to death and then leaves it. Beneath the thousand winsome attractions which make us love it, the cat preserves the old instinct which kept it alive when it had to battle in the far-off ages with animals as fierce and cunning as itself.

Man has taken the cat as he found it, with all its sleeping ferocity. He has not found it of service in hunting, as the dog has been, and so he has never tried to mould it to his will. It has been rather an advantage to man that it should remain a little savage, for it has made it more valuable in catching mice. But a kindlier cat could no doubt have been evolved. If men had reared the kittens of only kind-tempered, intelligent, affectionate cats, and prevented the kittens of fierce cats from living, and if they had kept on doing this from age to age, we should perhaps have had a breed of cats as gentle and dependable as dogs.

What we have done with cats has been to choose those with a pink eye and a blue one, with specially short hair or specially long hair, with specially long tails or specially short tails, or with no tails at all. We have always chosen cats, that is to say, for their appearance and not for fine qualities; and so, through all the changes they have undergone since they left the lairs of the savage beasts of Egypt and India, the nature of the cat has remained practically unchanged ; only its outer appearance has altered. Has anybody, in all the history of cat-shows, thought of offering a prize for the most intelligent and affectionate cat ?

How, then, does it happen that this tiger occupies so many hearths ? How is it that children and grown-ups love it ? There is a special language for cats ; it would not seem natural to address a cat in the ordinary human way. Children talk to their cats in the language employed by grown-ups in talking to babies, and in this special language a little girl answers the problem of this love for cats in the only way in which it can be answered. Addressing her cat, who is the most lovable scoundrel in the world, she hugs him to her little heart and croons, " He's a lickle old willun, but, oh, I loves him ! " What more than that can we say ? Cats are villains, but we cannot help loving them. After all, many a man who is well fed and happy in the country will take up a gun and say, " I think I will just run out and kill something ! " The cat is like that ; savage instinct comes out in both, and in this particular the cat and the man with a gun are exactly on a level, except that perhaps the cat may sometimes really need as food that which it kills.

It must not be said, however, that our domestic tiger has not improved by having been in touch with man. Clearly it has. Although we have not tried to evolve an intelligent cat, the domestic animal proves itself one of the most intelligent of all our four-footed friends. It is not as easy as some animals to teach, not as easy as the dog, not even as easy as the seal. But there are few animals which more readily teach themselves. Some of the things that one clever cat does are quite untaught. When he wishes to enter the house at night, he walks to the garden door of the study in which this story is written, stands upon his hind legs, and bangs with his paw at the heavy bronze handle. That he taught himself. It is his habit to escort his owner to her bath each night in winter, to sit on top of the bath and play with the water as it runs in. Then he will " ask " to be let out. The door is opened for him, and out he goes. The moment the door closes behind him, he turns back, stands upon his hind legs, and beats upon the handle. When the door is reopened he darts away and hides behind the curtains, and when the door is once more fastened he repeats the trick. He plays this self-taught game of hide-and-seek as intelligently as a child, and the game is his own invention. He hides, too, when he hears the step or voice of his little mistress, and at the last moment rushes out at her, scampers across her feet, gives her a tap on the ankles with his paw, and is gone.

THE TIGER PEERS OUT OF THE JUNGLE

When he is in the garden on an honest errand, he hears his name called, and will come if he thinks he will, but as a rule he thinks he will not. Once or twice he has been punished for prowling round the aviary and climbing the wires, to the great alarm of the birds, and now, when he is seen to be stealing across the lawn, a head pops through a doorway, and a scolding voice cries, " Puss ! " In the ordinary course he would take no notice, but those who study this cat are almost driven to believe that this check on his way to the aviary brings into action something like a conscience. He does not turn back. He plunges into the shrubbery, creeps a few yards up among the trees, and then skips out on to the lawn, and comes galloping to the house as if his life depended on his speed. Does Tibby think he has deceived the person calling him ? If so, the fondling he receives must encourage his belief.

There was a delightful story in a newspaper of a cat which slept in the wintertime in a snug study. As a rule, a gas fire was lighted, and the cat would snooze beside it. One night its master was absent when the cat entered the study, and there was no fire. Its mistress watched and saw the whole of the events which followed.

The cat went to the hat-stand in the hall, sniffed and missed its master's umbrella and coat, raced upstairs to his bedroom, leapt on to his bed, sniffed about the pillow, then, with a discontented cry, ran downstairs to the dining-room, where his mistress, who had followed, took a seat and pretended not to notice. The cat sidled up to her, put his paws upon her knees, and gazed into her face, with a sort of gasp. She got up, and he walked before her to the study, stepped inside the fender, put his paws on the stove, and then turned his head over his shoulder, with a look of gratitude that she had been clever enough to interpret his meaning. Need it be added that the lady lit the fire for him ?

Scientists do not know everything, because they have not time to read everything. One of the things they say is that no animal has ever shown itself wise enough deliberately to set a trap and bait it with food for the luring of its prey. Now, every reader of this book of ours knows that insects and fishes set traps. We have only to think of the ant-lion as a trap-builder, and of the angler-fish, which carries his bait upon his head, to remember that the idea of trapping and baiting is not unknown in the lower world. But, say the scientists, that is not the sort of trap-baiting that we mean. They mean, of course, the deliberate placing of food which is to lure animals within reach of the enemy lurking in hiding. Well, Professor Romanes, a great British naturalist, gave a good deal of attention to this very subject, and he found three clear instances, in each of which a cat was the hero. In the first, a cat used to lie in ambush for birds which were attracted to the crumbs scattered by a kind-hearted family in frosty weather. When the weather became less severe, the supply of crumbs ceased, and so did the gathering of birds. The cat was then observed to take crumbs in its mouth and scatter them on the grass in the old place, and go into hiding as before. One case

THE CAT PEEPS OUT OF THE GRASS

standing by itself would be doubted, but two more are quoted, one in which the cat itself carried the crumbs, another in which the animal scratched away the snow which covered them, and then hid itself.

CATS THAT LIVED 3000 YEARS AGO
Now in the British Museum

Other examples of unsuspected intelligence in cats have been furnished by people who have been giving evidence on oath. There was a case in England in which a woman was aroused from sleep by the persistent attempts of her cat to wake her. She pushed it away, but it returned and scratched her arm, a thing it had never done before. This made her jump up in bed, and she discovered the cause of the cat's strange behaviour—her husband lay in a swoon on the floor. In other cases a cat has aroused a family threatened by fire—aroused them, not by rushing about panic-stricken with terror, but by scratching at the bedroom door, or, if able to enter the room, patting or scratching the sleepers with its paws.

What possible explanation can there be of acts such as these except that cats do "reason"? They do not display the intellect of a child, but they show as clearly as possible that a problem has occurred to the lowly mind of the animal, that that problem has shown the existence of danger, and that the cat has done the wisest thing by calling its master or mistress.

PETER THE PERSIAN, BEHIND WHOSE FRIENDLY EYES THE SPIRIT OF A TIGER SLEEPS

Many of us during the holiday season have been worried by the misery of leaving the cat during our absence, and there can be no doubt that a cat grieves for absent friends. The writer's cat often will not eat when he is away, but sits upon one particular chair, from which it can see the front door, waiting for him to return home. Yet, though some cats fret when we leave them, other cats perform marvels of travelling when we take them from one home to another.

A great French naturalist has been writing on this very subject. Twice he had occasion to move from one house to another, and in each instance the removal meant the crossing of a river. In each case a cat returned from the new house to the old, and each cat swam across the river—a thing a cat hates to do. The French naturalist does not attempt to solve the problem as to what instinct draws the cat back to its old haunts, or what instinct enables it unerringly to find its way, but he suggests that cats have the same homing instinct as a bee.

It is as certain as anything we know that animals and birds in a state of nature have what we call a sense of direction—the power to find their way where civilised human beings would be lost. A savage is rarely lost on a plain or in the forest, and we know that the maps of the world have been filled in largely with the help of savage guides. The savage has still the sense of direction, which some call an instinct, and many animals appear to have it also. Surely there is nothing more wonderful in a cat finding its way across a few miles of unknown country than in a young cuckoo finding its way, unguided by its parents, whom it never sees, from England to Africa. Even a crab will travel eighty miles to its home, and a humble limpet goes out and back to its home again with every tide. The cat is not alone, therefore, in the power of finding its way in strange country.

But why should the cat forsake its friends to go back to an empty house? Perhaps there are reasons, if we will think them out. We saw at the beginning of this story that the cat is never quite so friendly as the dog, that it is always a little independent, and a wanderer from the hearth. Well, in its rambles it meets many of its own kind. They, and not the people of its home, are its true family. The house in which the cat lives is merely the centre from which it moves among its own kith and kin. Fond as we may be of a cat, we are fonder of our own flesh and blood, and a cat must be fonder of other cats than of even the kindest human being.

WATCHING AND WAITING

The house is its shelter, and the source from which it obtains most of its food, but its kindred are in the neighbourhood around. Are they not the attraction by which it is drawn back, and may it not feel that in order to renew acquaintance with them it must go back to the old home from which it has been wont to sally out to meet them? The cat mind is not sufficiently advanced, it may be, to enable the animal to divide the thought of the actual house from the good times it has had there, so it goes back, even though the place is deserted and its human friends are gone.

We have not mastered all the mysteries of the cat's mind, perhaps because we have not studied it; but there is more imagination, more humour, more fun, and more affection in this tiger on the hearth than the casual observer has troubled to note. With all its faults, the cat simply must be loved, because it is such a wonderful companion, such an ally when it really lets itself go, as we say. There was a most touching illustration of this at Nuneaton, in England, only a year or two ago. An aged farmer and his cat were the closest comrades, and when he went at night to tend his cattle the cat always accompanied him. He had to cross a railway track, and, though the cat hated trains, it never deserted its master. One night the poor old man was killed by an express. The cat's quick hearing would almost certainly warn it in time, but it stayed with its master and died by his side.

Just one other example of this comradeship. Our intelligent cat, if it ever wanders outside the garden, will fly as for dear life if a dog so much as sneezes. One day, however, the cat ran for shelter to the study door, its back arched, its eyes glaring, and spitting and fuming like a baby steam-engine. The cat's friend went out, saw a huge strange dog, and ran after it. There never was such a pretence of bravery as that cat then displayed. It bounded like a flash in advance of its friend in hot pursuit of the terrible enemy, and the dog, seeing man and cat both in chase, turned tail and fled, howling. The curious thing is that the moment the man ceased running the cat stopped too, and hurried back as if to remind the man of an important engagement in the study. It was all a make-believe heroism, a "showing-off"; but there is a glimmer of mind, surely, in that itself, and so, if the cat is a villain and a tiger—well, a cat may be loved and loved, and be a villain.

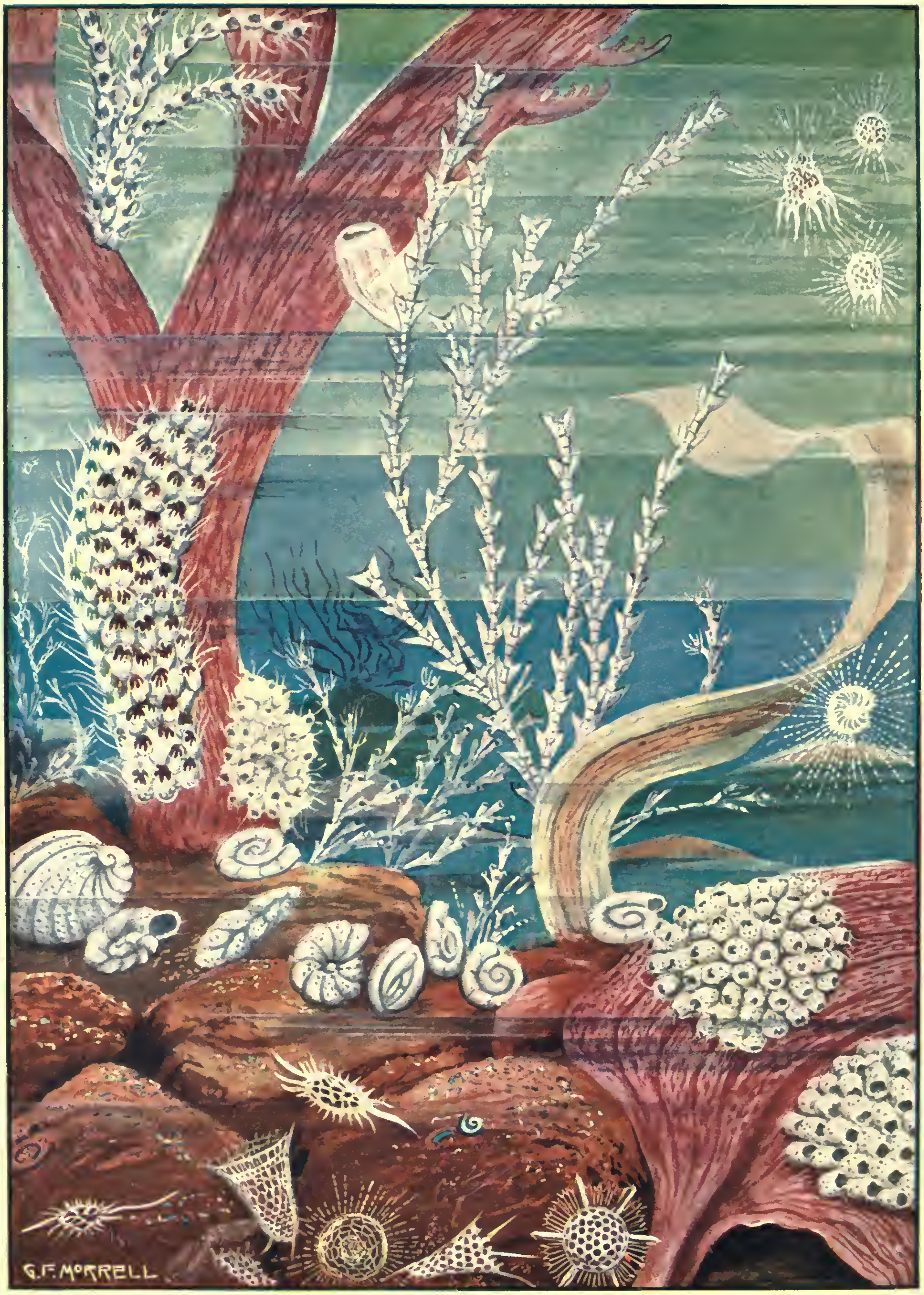
After all, the presence of cats in the home is a sort of triumph for man; it is the cat's quiet tribute to his tolerance and kindness of nature. Tigers and the rest of the cats do not associate with other animals, but keep sulkily to themselves. But the ancestors of the domestic cat found, ages ago, that man might be trusted. It crept on to his rude hearth in the caves, and has remained to share his lot in cottage and palace. Man has demanded no service in exchange for his hospitality. For all its untamed heart and its tigerish ways, we accept its presence with joy, a little proud, perhaps, that an animal instinctively and naturally fierce should gently fit into our household lives.

Fit gently it does, for, if a cat is a villain, it may sometimes be gentle-hearted, too. There is a Persian cat named Peter whose portrait appears in these pages, a cat of high degree, who sits on the hearth in a lovely hall in the North of England and listens to all the secrets that a member of Parliament has to tell when he comes home tired from London. And Peter is as good as he is beautiful; perhaps we should say he is as good as he is bad. At any rate, this Peter has been seen to do—he has been seen to take care of a mother cat's kittens while the mother goes to her corner of the dining-room to dine. When dinner is over, and the mother comes back, Peter the Persian walks away and attends to his own affairs; and to this day he can never have guessed that he is a sort of hero in a story. Yet he *is*, and in these pages you will see him, though Peter may look at himself here and not know in the least that it is he. That is the wonder of wonders—that we know Peter and his history, and Peter himself does not. He may have lost the ferocity of the tiger and become a peaceful cat, but he can never look back to yesterday or forward to tomorrow. While we know the most that a cat can do, who knows the most that a child may do?

A CAT KNOCKING AT A DOOR

A CAT RINGING A DOOR-BELL

THE GLORY THAT LIES HIDDEN IN THE SEA



A FRAGMENT TAKEN FROM A ROCK POOL BY THE SEA, AND DRAWN AS SEEN UNDER A MICROSCOPE

The small patch at the left shows the actual size of the fragment.

THE INVISIBLE SEASIDE

A FEW HOURS ON THE SANDS WITH THE MICROSCOPE AND WHAT WE SEE IN IT

THE MARVELS MOST PEOPLE MISS ON THE BEACH

The visible seaside is a glorious place to be at; the invisible seaside is marvellous beyond compare. In a chance grab by the hand in the sea, in a profitable haul by the net, in the hazard of a spade plunged at random in the sand, may be a pageant of wonder and splendour which have startled the greatest minds. We cannot see them with the naked eye; the most powerful magnifying glass will hardly provide the key to this hidden world; we must have a microscope.

When the last splash is over, the last turret of the fortified castle left to flaunt before the tide, then, with our spoil from the brim of the vasty deep, we go home for the evening and, with eyes assisted by the microscope, let ourselves into a new and magic world. We drop a pinch of dried sand into water, and the effect is as if we had cast a spell upon it. Up pop ready-made exhibits for the microscope. We may not know that they are there, so tiny are they; but a neat-handed little student will gently skim the surface of the drop of water with silk or fine gauze, and submit the result to his microscope, and lo! the result is as if Aladdin's cave had opened and yielded us new treasures. We shall find before us the most exquisite little shells, tinier than the sand-grains, yet so beautiful and perfect that we gasp with wonder at them.

Each of these shells tells us the story of a life, a complete life, of the existence of a little animal which was a child and became a parent of animals like itself. It is one of the miracles of sea life, of which, without the microscope, we should not dream. But the wonders are not all hidden in the small compass of these tiny shells; we find them in the substance of things with which we are all familiar—in the starfish, in the whelk, in the seaweeds and the algæ, in the armament of the sea urchins, in the mysterious make-up of the sponge. There are more things on the beach and in the sea than are dreamed of in our holiday philosophy.

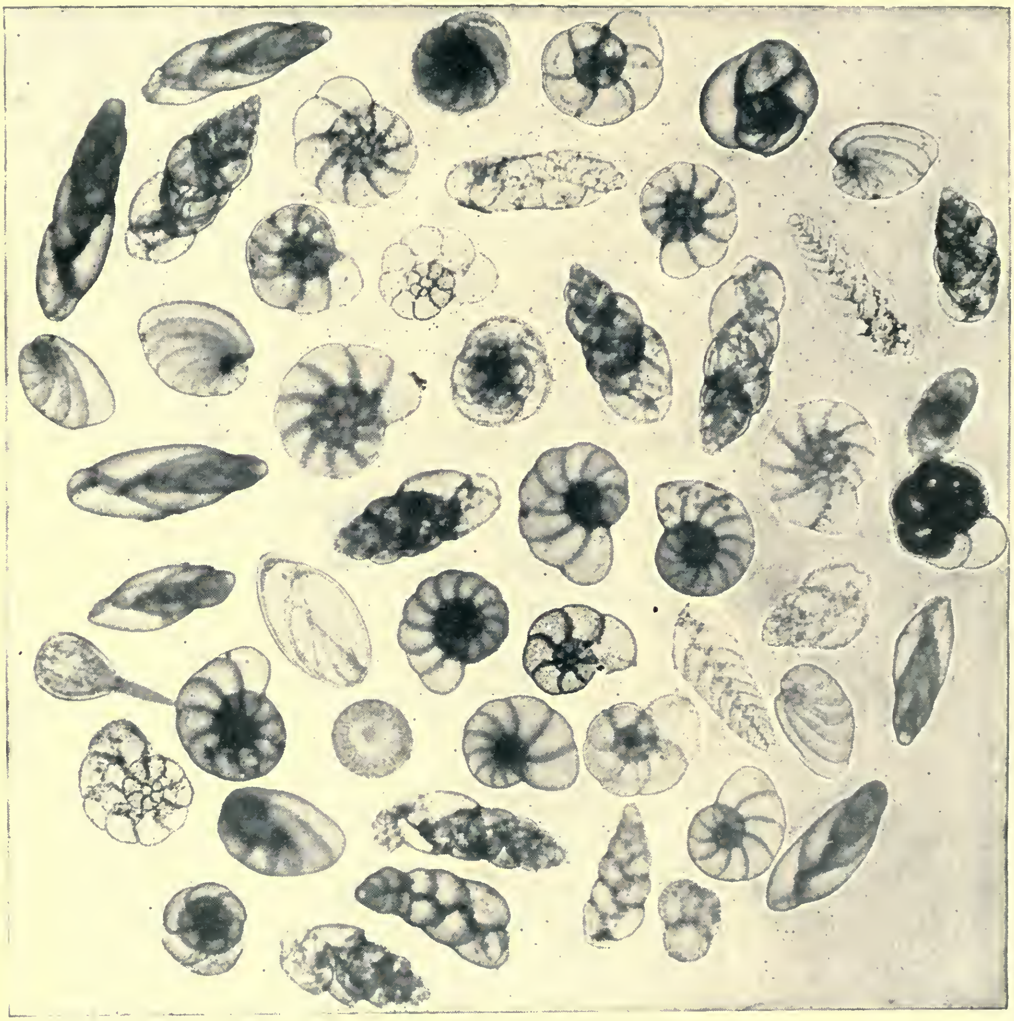
The microscope takes us at a bound back to the dawn of creation, when life-forms were all so nearly related that there could have been no sharp dividing line between the animal and the vegetable. When we put away the microscope for the night, and plunge into our bath before going to bed, let us give a moment's thought to the sponge we use. What is it—animal, vegetable, or manufactured?

Wise men, until not very long ago, thought sponges were sea-vegetables, or simply *worm-nests*. Yet the sponge is an animal, living by admitting water and tiny particles of food into its small canals, taking from the water oxygen for breathing and food for the support of life, and then expelling the water through the large openings which every sponge reveals. There are many types of sponge, some of them armed with a multitude of little spicules—like flinty spears and barbs—which support the skeleton of the sponge and make it difficult for its foes to eat. The microscope reveals these spicules to us, and an astonishing collection they form. Each has a purpose, each is definitely formed, and resembles the other spicules of the same type; they are not chance creations. Let us glance at some of them under our microscope.

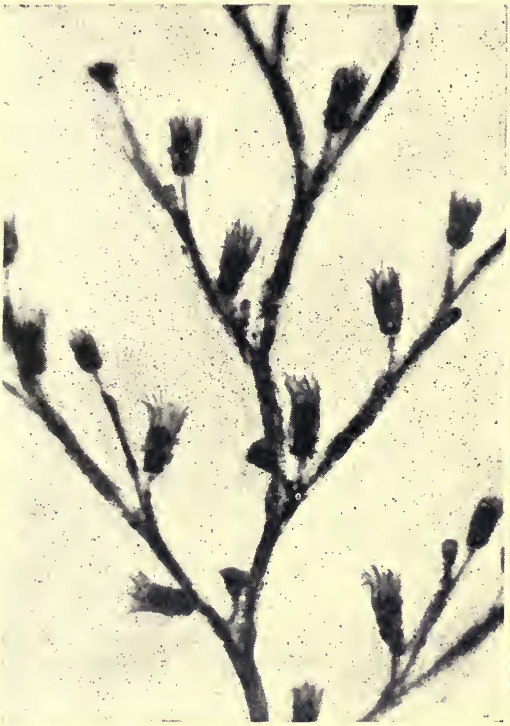
Man might have borrowed half a hundred outlines for his implements from these spicules: boomerangs, lancets, walking-sticks, grappling hooks, barbed crescents, discs, heraldic emblems, ellipses, and stars—all these are found in a sponge, the animals which can multiply by budding like a plant, or, like a dragon-fly or a frog, by setting free in the water eggs or living young which race and spin until they are tired, and then, remembering that they have no backbone, sit down on a piece of rock and stay there, lose their animal form, and gravely turn into ordinary sponges. Funny little fellows! they seem to have great ambitions at first, but they have what we should call a bad family record. For sponges came from a higher form of life, and have degenerated and drifted off the line of progress.

Sponges are sold by the pound, and dishonest dealers try to increase the weight by filling them with sand; so that wise buyers insist that they shall be allowed to beat and wash the sponge before buying it. The stuff that is released from the sponge is waste to the merchant, but it is treasure to our microscope, for the sand is almost certain to be heavily charged with foraminifera. That name, we may as well remember, simply means "hole-bearers," because the shells are full of pores from which the tiny animals thrust their filaments.

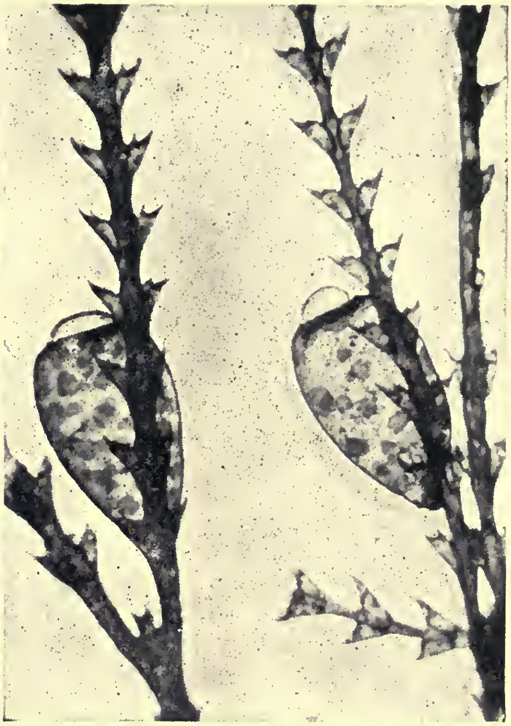
The foraminifera are one of a great group of animalcules known as the Rhizopoda. They are simple little masses of jelly, eating without mouths, digesting without stomachs, moving without feet, catching prey without hands. They are very near the lowest types of life from which all animals arose. Their bodies consist of protoplasm, a jelly-like substance, higher than plant life, yet less exalted than the flesh of the lowliest fish or reptile. But these lowly atoms of life, each in his marvellous little shell fortress, stretch forth their filaments, catch particles of food, draw it into their shells, absorb it by some mysterious process, digesting that which is


SHELLS LIKE PIN-POINTS—THE HOMES OF FORAMINIFERA, TINY CREATURES OF THE SEA

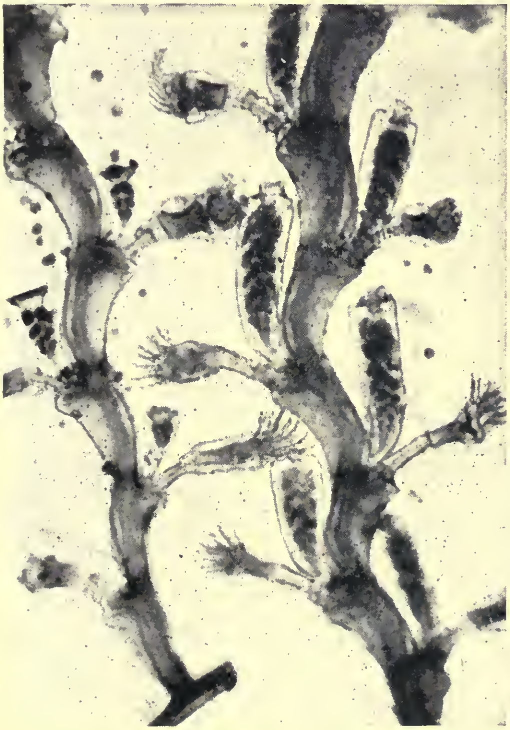
A PEEP AT THE PLANT-ANIMALS OF THE SEA



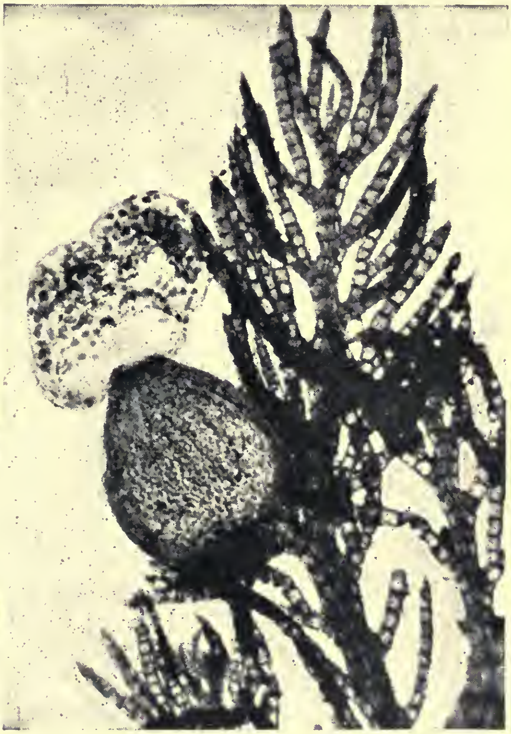
THE BUDS OF A ZOOPHYTE, OR PLANT-ANIMAL, WHICH SPREAD OUT TENTACLES TO CATCH FOOD



THE CAPSULES IN WHICH THE YOUNG OF A ZOOPHYTE ARE BORN AS FREE-SWIMMING JELLYFISH

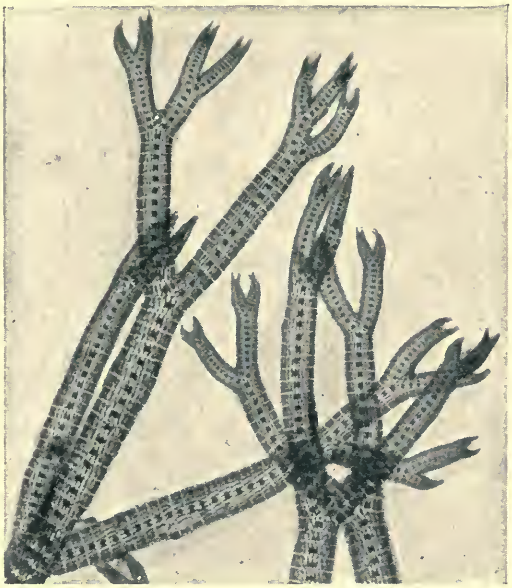


THE BUDS OF THE POLYPE OBELIA, WITH EGGS FROM WHICH SMALL JELLYFISH EMERGE

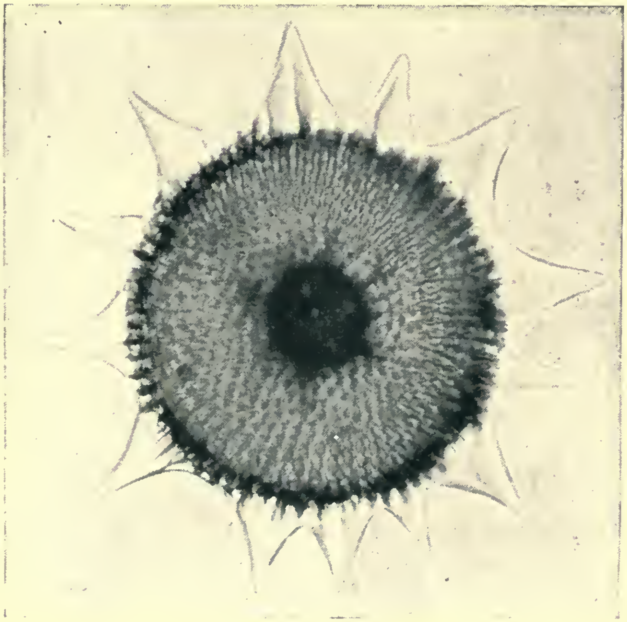


MARINE ALGA DISCHARGING ITS CAPSULE OF SPORES INTO THE SEA

All the pictures on this page are highly magnified. The lower picture on the left shows a branch of the plant-animal Obelia, not more than a sixteenth of an inch long digestible and discarding that which is not. They seem able to make a mouth of any part of their bodies which food touches; their bodies seem to open where they will.


THE HIDDEN BEAUTY OF A PIECE OF SEAWEED

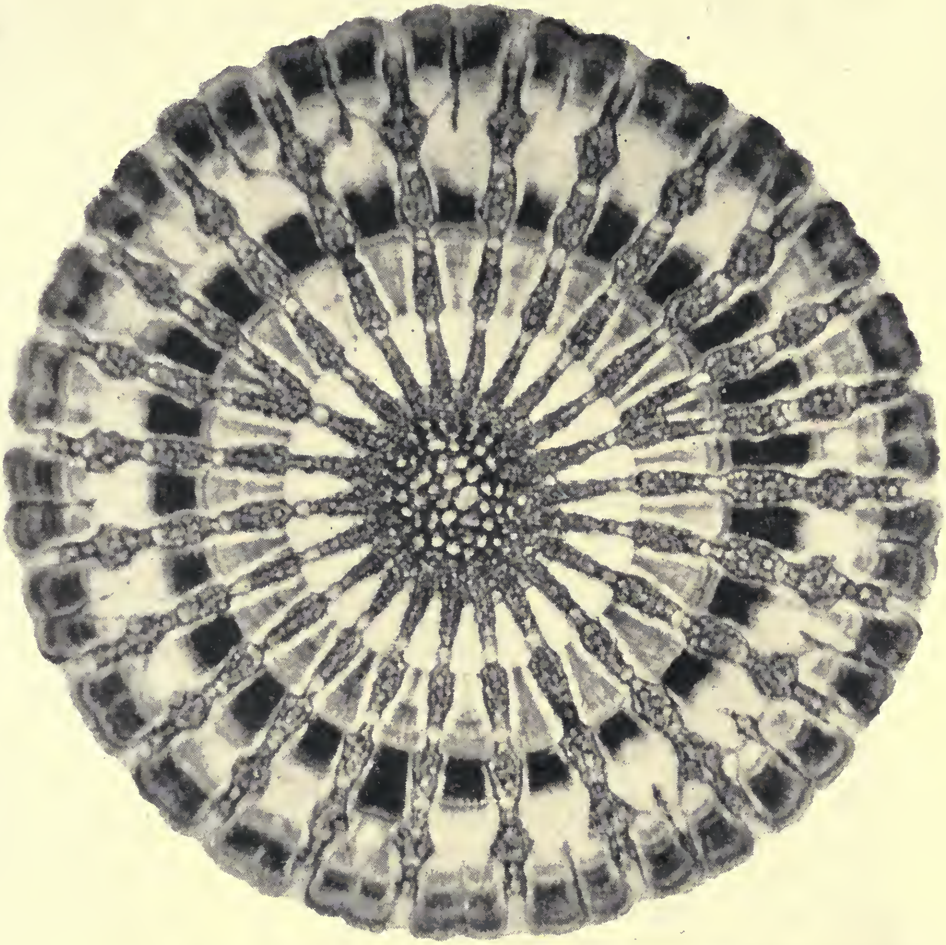
And these infinitely tiny things are great builders, builders for themselves and man. Like the lordly clam or oyster, these foraminifera extract carbonate of lime from sea water and form their shells. The shell may resemble porcelain, it may resemble glass, it may consist simply of grains of sand cemented together; it may consist of only one or two cells, or it may be made of ten or more. At times the little animal thrusts its body out of the shell so as quite to cover the exterior of its home. It may then absorb food, or may be forming a new cell to its shell. The foraminifera multiply either by budding off, like many other forms of lowly life, or by hatching their young within the shell. When that happens, the baby foraminifera do not quit the parental dwelling until they have formed shells themselves, and it has been found that, at the end of this process, the body of the parent seems to have been given up to the offspring, for, while they have appeared as tiny fragments of life fortified within castle walls, the shell of the mother has been found empty, as though her flesh lived again in theirs.


A SEA-CREATURE SMALLER THAN A PIN'S HEAD. A POLYCISTIN UNDER THE MICROSCOPE

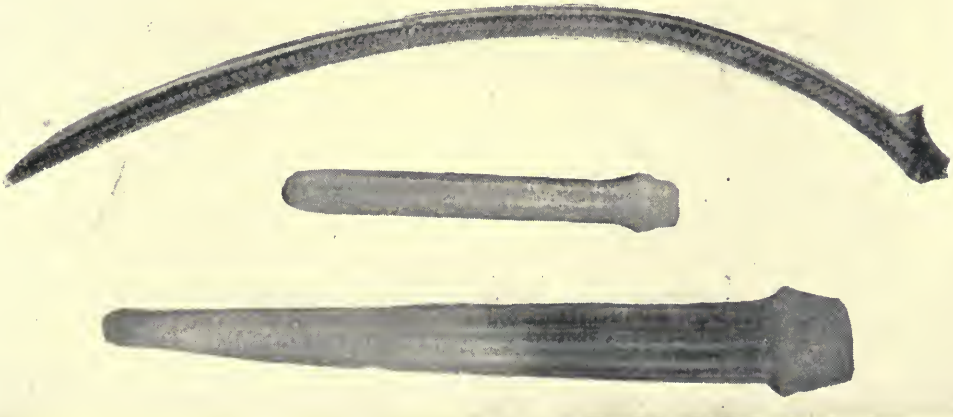
These mysteries are achieved, be it remembered, by animals so small that only by the aid of the microscope can we see them at all. There are unthinkable swarms of them in the seas. When they die, the little soft body part is quickly dissolved, but the shell remains, and billions and billions of such shells form the white walls of England. The cliffs of Dover are mainly composed of them; our chalk and limestone, which compose a great part of continents and great ranges of mountains, are largely made up of shells of dead and buried foraminifera. Today the dying hosts of foraminifera are helping to form a new oozy bed to the Atlantic, from which bed some day a new continent may rise. If the Channel Tunnel is ever built to connect England with France it will run through chalk that was once a living host of foraminifera and other sea animals in microscopic shells.

Mingled with these creatures we find another group of the very, very tiny—the polycistina. The giants among the polycistins are not as big as a pin's head, the smallest are but specks of dust, yet all reveal the most exquisite design and complicated arrangement. The shell is perforated by numerous holes, not in the same way as the foraminifera, but in the form of a

A SIGHT THAT A MAN CAN HARDLY BELIEVE



WHAT THE SPINE OF A SEA-URCHIN IS LIKE INSIDE—THE MARVELLOUS STRUCTURE THAT NATURE COMPRESSES INTO THE SIXTEENTH OF AN INCH



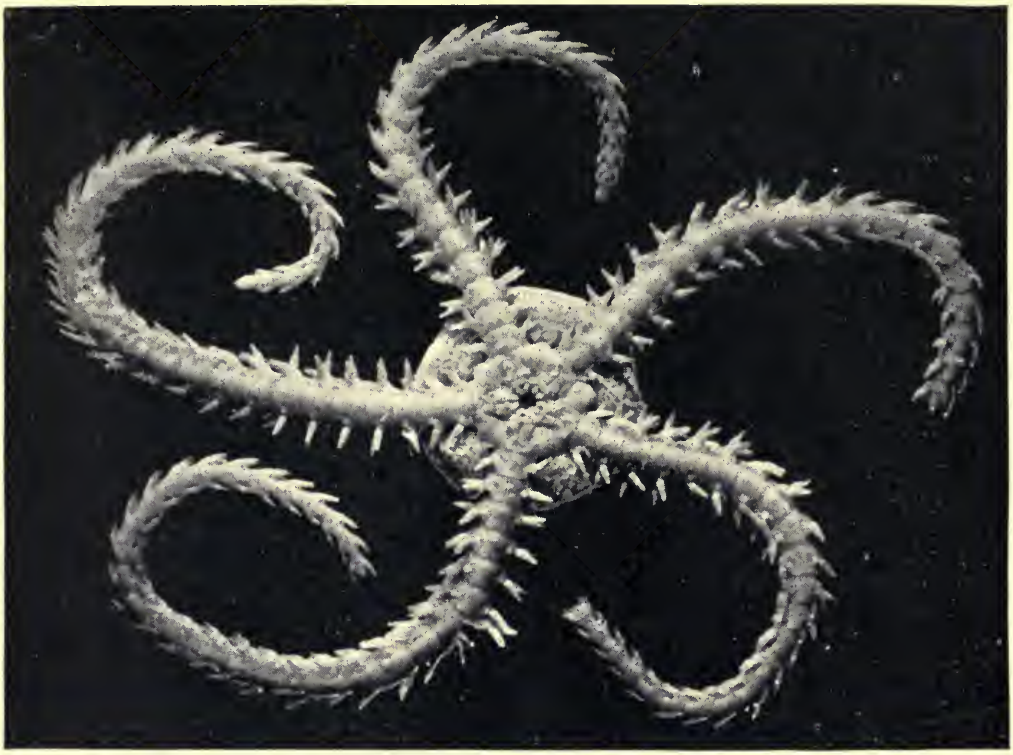
THE PRICKLY SPINES OF A SEA-URCHIN, MUCH MAGNIFIED. IN REALITY THEY ARE LIKE PINS. THE LARGE PHOTOGRAPH ABOVE IS A SECTION ACROSS ONE OF THESE SPINES lattice work. These little animals had long been known as fossils in rocks which had been examined under the microscope, but when living specimens were found and sent to a great scientist, the scientist sang a sort of hymn of thanksgiving for having lived to see them.

They link the life of our own age with the beginning of all animal life, and though, as the scientist said, they are inferior in individual energy to lions and elephants, in their united influences they are far more important than these animals. The foraminifera and polycistina are not, of course, the only numerous tiny people of the deeps. Diatoms crowd the waters. They are specks of protoplasm enclosed in shells, which, if we ourselves could inhabit them, would seem to us palaces of pure delight, so beautiful are they. They are in every sea, in every river and lake; the wind of the ocean carries them like fine dust. Dying, they leave their shells, with those of the other little animals, to form new ocean beds. But they are in the rocks of old time; they are in the soil of Siberia and Lapland, and when famine comes, the natives there gather up the soil in which they are embedded, mix it with their flour, and eat it, to get even the small food values still left in the uncountable shells.

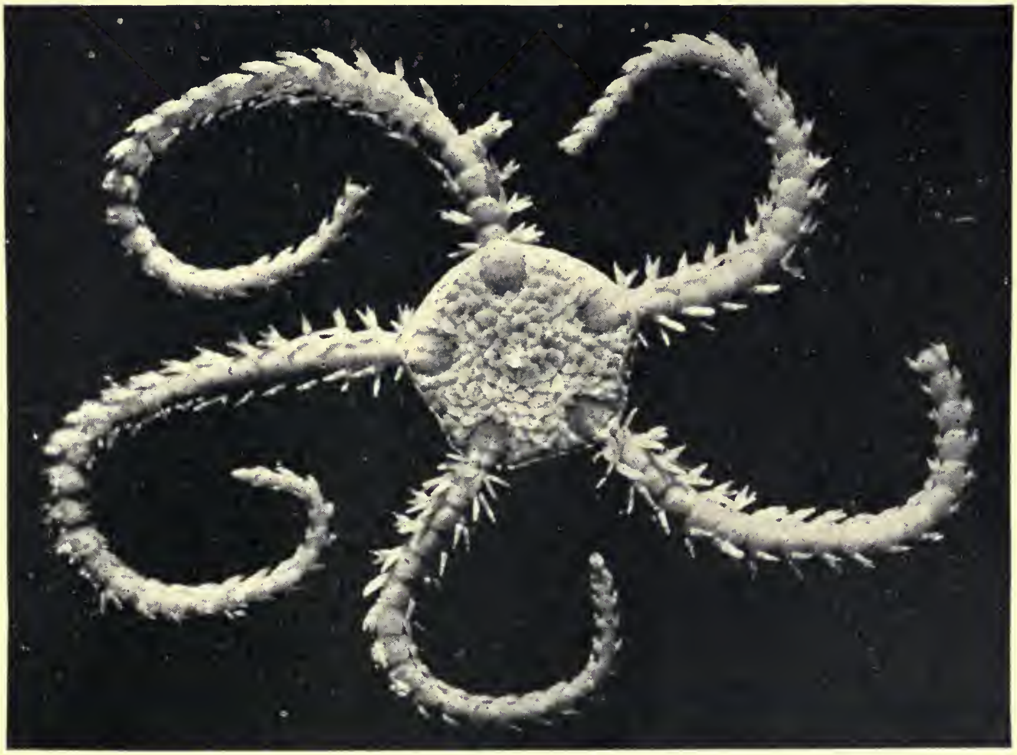
THE VEGETABLE LIFE OF THE SEA—A BRANCH OF MARINE ALGA IN FRUIT

Men in rocky countries have myriads of diatoms under their feet; men in civilised lands use earth crowded with diatoms to make dynamite for blasting railways and tunnels through mountains and deepening harbours. It is a moment of great excitement for us, then, when a diatom takes his place under the lens of our microscope. Tiny as are the diatoms, they have wonderful markings, and it has been found that the tiny cross markings on some of them

THE AMAZING THING THAT LIES ON THE BEACH



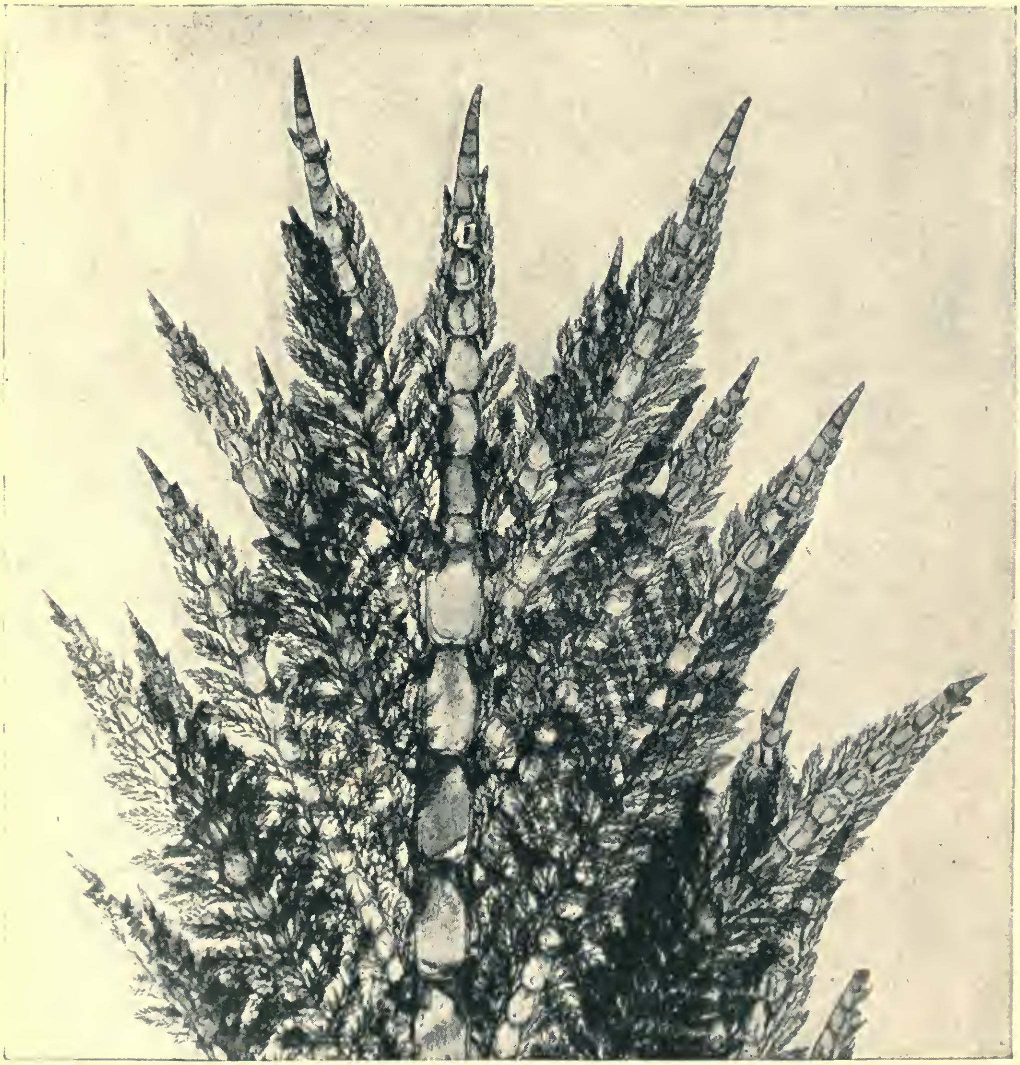
THE LOWER SIDE OF A STARFISH UNDER THE MICROSCOPE



WHAT A STARFISH IS LIKE WHEN WE LOOK AT IT CLOSELY—THE UPPER SIDE represent from seventy to over a hundred thousand for each square inch of surface.

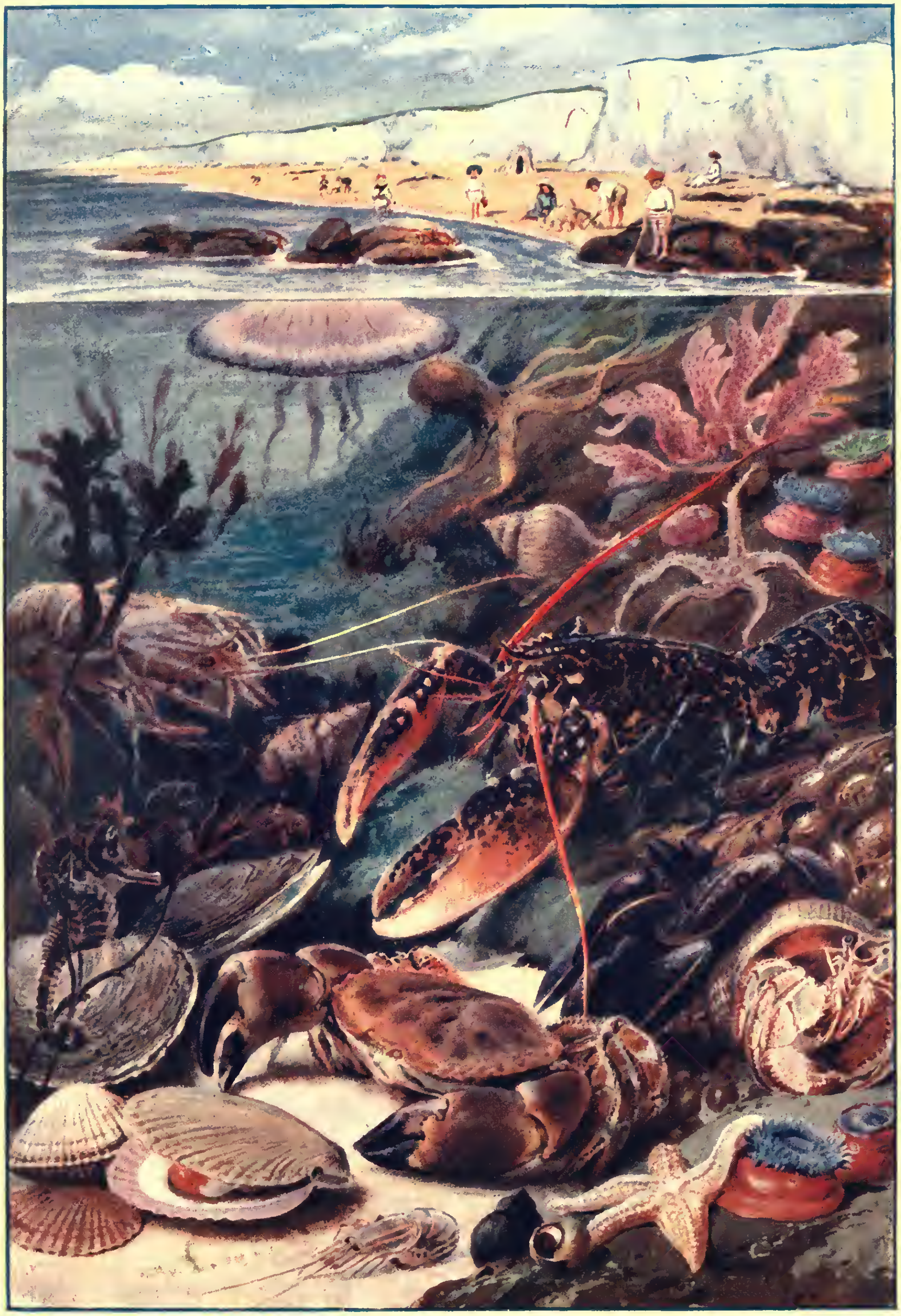
Diatoms are on the border line of life, between vegetable and animal, but we come to a more mysterious form in the zoophytes. The name means plant-animal, and it embraces the sponges, the corals, and the anemones. Zoophytes are as mysterious as the name suggests. We look down into the clear sea water and see beneath us a garden, or a portion of a forest, growing under the waves; but when we get a piece of one of these sea plants, such as the sea fir, under our microscope, we find that each end of a branchlet contains the young of the plant—not a seed or a bud, but a living animal! The whole growth seems to be a plant; the children are animals!

The mystery is revealed to us in a sprig of the tiny sea fir. The microscope shows us that each end of a branch is a hollow chamber, closed with a hinged lid as finely made as that of the trapdoor spider, only infinitely smaller. Within is a polyp, which at will thrusts its little jelly-like body through the opening, stretches forth its tentacles, catches its prey, eats it, and feeds the whole of the colony. It is a wonderful organisation. The food-catching polyps are like the worker bees in a hive. They catch and eat food, and digest it, and, as their bodies are joined to the bodies of



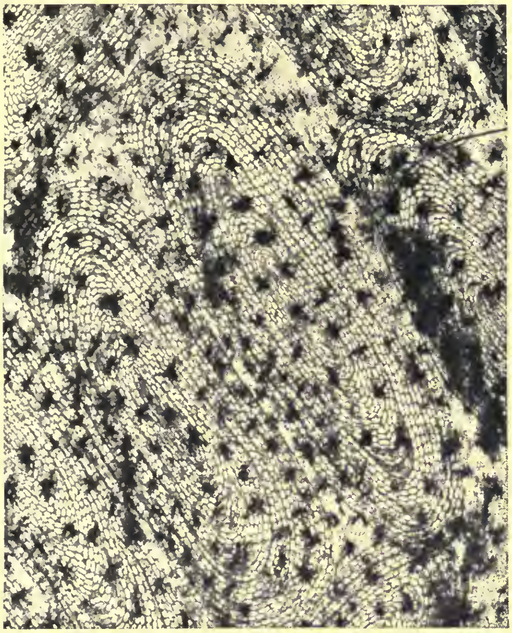
A BEAUTIFUL PIECE OF ALGA GROWING IN THE SEA

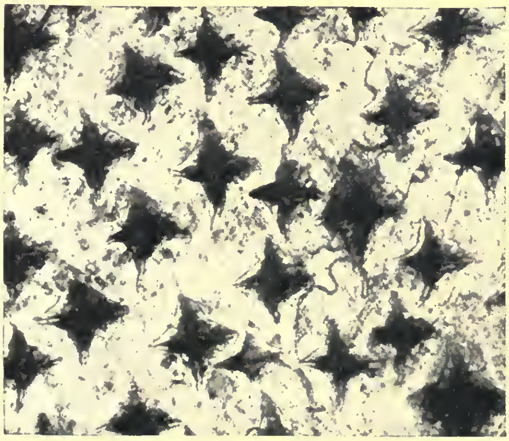
OUR UNSEEN NEIGHBORS ON THE BEACH



We should be surprised, as we sit on the rocks watching the waves roll in, if we could see the life in the sea almost at our feet. This picture shows us many strange creatures which we shall recognise, for, though they are mostly hidden, we can find them in the pools. There is no more delightful occupation when by the sea than to search in the rock-pools for creatures such as these—jellyfish, cuttlefish, whelks, sea-anemones, prawns, lobsters, sea-horses, oysters, mussels, crabs, hermit crabs, cockles, scallops, shrimps, winkles, starfish, and various kinds of seaweeds.

the other polyps in the colony, the digested food passes on from the bodies of those that catch to those that do not catch, and on to those which produce other polyps. These polyps produce eggs in capsules, which, after various changes, leave the parent colony and take their way in the sea as free-swimming animals. Each of these young ones is able to start a colony of its own, as in the case of the queen wasp or the queen bee.


THE SKIN OF AN EEL


THE SKIN OF A DOG-FISH

As the embryo grows up, it becomes enlarged at one end, the filaments by which it has swum disappear, the embryo becomes shaped like a disc, and, settling upon a rock in shallow water, it forms into a single polyp. And from this single polyp develops a new "plant," *alive*, a seeming plant which puts out branches and buds, every bud becoming a polyp for gathering food or producing other polyps. All this incredible story is revealed to us by our microscope, which has still greater wonders in the same field for us. Many of the zoophytes with which the shore is strewn after wind do not simply send forth young which are free-swimmers ; they send forth young in a shape which we all know by another name. The Medusa jelly-fish is simply the young of these seeming plants, jelly-fish which sting, catch sea animals smaller than themselves, and bud off other jelly-fish like themselves.

Such a process almost passes belief, but it is not without parallel in types of life much higher than the zoophytes. The mysterious axolotl, a famous Mexican newt-like creature, gives birth to other axolotls like itself, but, to everyone's amazement, it has been found that the axolotl is only a tadpole ; in its adult stage it becomes the salamander, known as the Amblystoma. Many of the polyps and zoophytes produce children unlike themselves, and we have a beautiful example in the obelia, whose babies sail away as jelly-fish, only a sixteenth of an inch in length.

The marine algæ, again, give us wonderful results in the microscope. Let us examine a spray, which under the lens looks like a towering tree colonised by a horde of fruit-bats. Actually it is a very small example of sea life, and the dark globes are capsules containing embryos, which will break away to form new colonies. Another example shows us capsules of eggs, looking under the microscope like a cluster of frog eggs after they have been swollen by the entrance of water. Many of the loveliest examples of Nature's decorative scheme for the seaside are revealed by the microscope in our algæ : they are attractive enough to the naked eye, but the microscope seems to take us into the heart of a secret which Nature had sought to keep from the sight of mankind. With our artificial eyes, so to speak, we see things which have been hidden from us ; we see not only the means by which the parent plant produces its spawn, but the very cells of which the parent plant is built up.

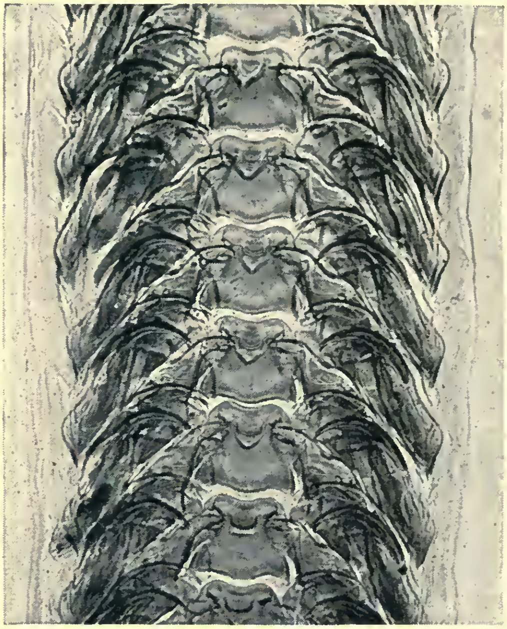
The algæ are lower than the other forms of life we have been considering, and are for that reason, perhaps, not so interesting as those a step higher. The scientist puts his finger upon the group to which the jelly-fish, the sea anemones and corals belong, and says, practically with certainty, "These represent a stage in the development of animal life through which all the higher forms have passed." Higher life has gained enormously, of course, but it has lost some of the qualities of lower life, which remain a mystery to us today. The jelly-fish—tiny microscopic things the eye cannot see, except by the light they give at night, or from the hues reflected from their bodies in the sunlight of a still sea-pool—are among the marvels which light the dark sea with a splendour like that of the fireflies on land. The internal structure of this creature has no known parallel in Nature. In its more primitive form the animal had a simple intestine, and from this has radiated a digestive canal which fills the whole of the interior of the body with no closed system of blood-vessels, with no specialised plan for breathing. It is all amazing in its simplicity, an astonishing look-back on what has been the past of all exalted life-forms on the earth and in the waters. We may well apply to these creatures the poet's lines, remembering that the word "runes" means simply an old type of alphabet :

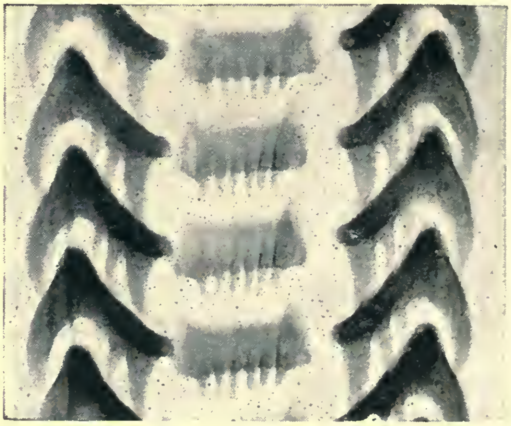
Runes of a wasted purpose writ in clay,
Poor dwindled souls that lost the upward way
In Memory's morning when the world began.

We must leave the tinier forms of life, but we need not put away our microscope, for it has unsuspected treasures to discover to us. We pick up a sea urchin, let us say, and find it armed with prickles—a veritable little hedgehog of the sea. How wonderful is this armament under our glass!

The little spines are meant to protect the soft-bodied urchin from the hungry jaws of the mighty, and to assist in capturing prey ; some of them, in certain species, convey poison ; some are so set that they can incline this way and that, with just enough play to enable them to present an angle which will drive them into the mouth of any enemy that assails them. The spines are perfect examples of Nature's devices in armament. Some are curved like scimitars, some are straight and needle-like. Contrast them with the spines of the starfish, with which most of us are quite familiar. Those of the starfish are of quite a different pattern, with heavily notched edges of the type that would either grip or inflict a rough wound.

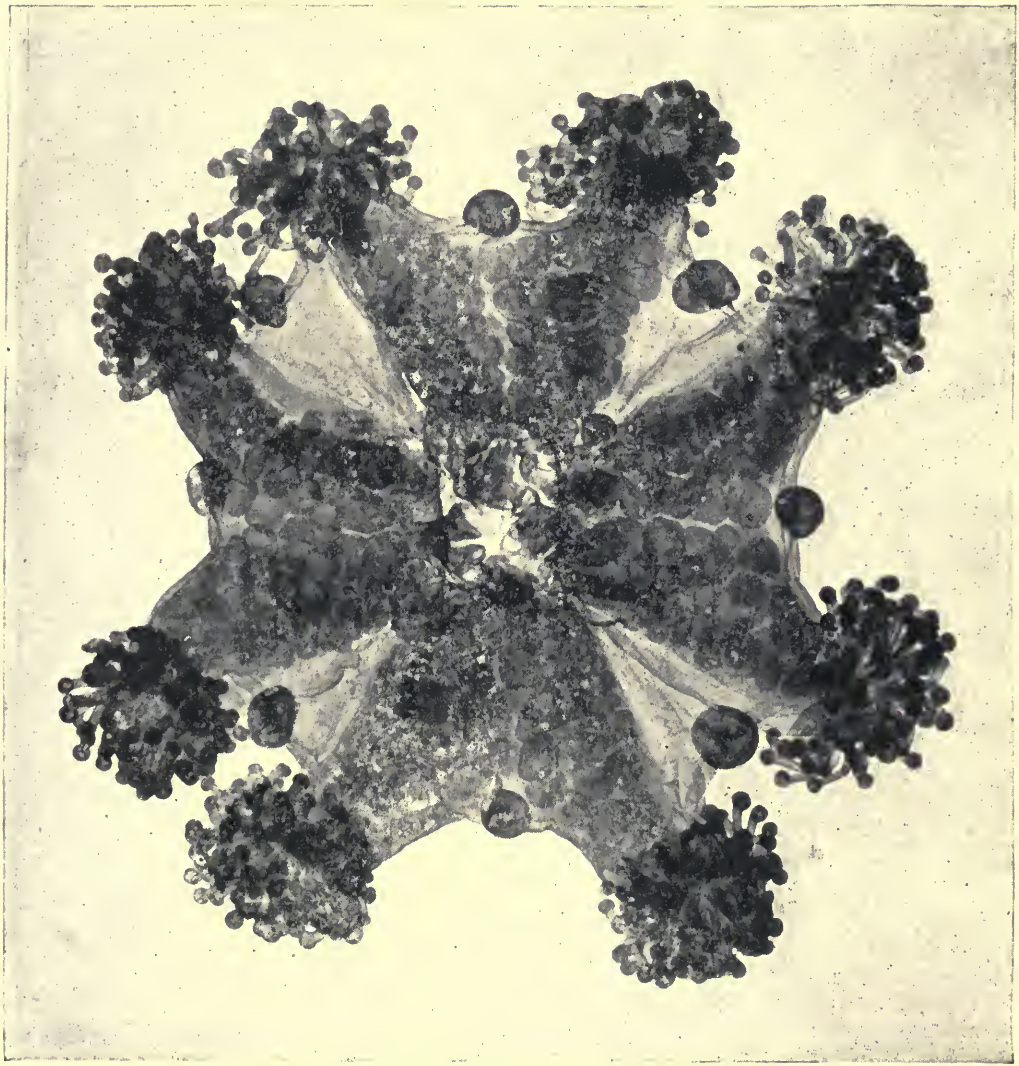
We see here what naturalists mean when they say that Nature repeats herself. In looking at a section cut through the spine of a sea urchin, we see a marvellous scheme of architecture almost beyond our power to believe ; in looking at the spine as a whole we may fancy that the microscope is bringing us in touch with the potent weapon of the swordfish, but in the spines of the starfish we may imagine that we are beholding the small working model on which the hideous barbed implement of the sawfish was designed. What a curious creature seems the starfish before us! Look at the dim red eye, carefully guarded by spines, near the tip of each arm ; note the wonderful sucker processes by which the animal pulls itself along. His habits are cruel, as we think, but they are extremely interesting. He straddles an oyster or a mussel, raises him-


THE PALATE OF A PERIWINKLE


THE TONGUE OF A WHELK

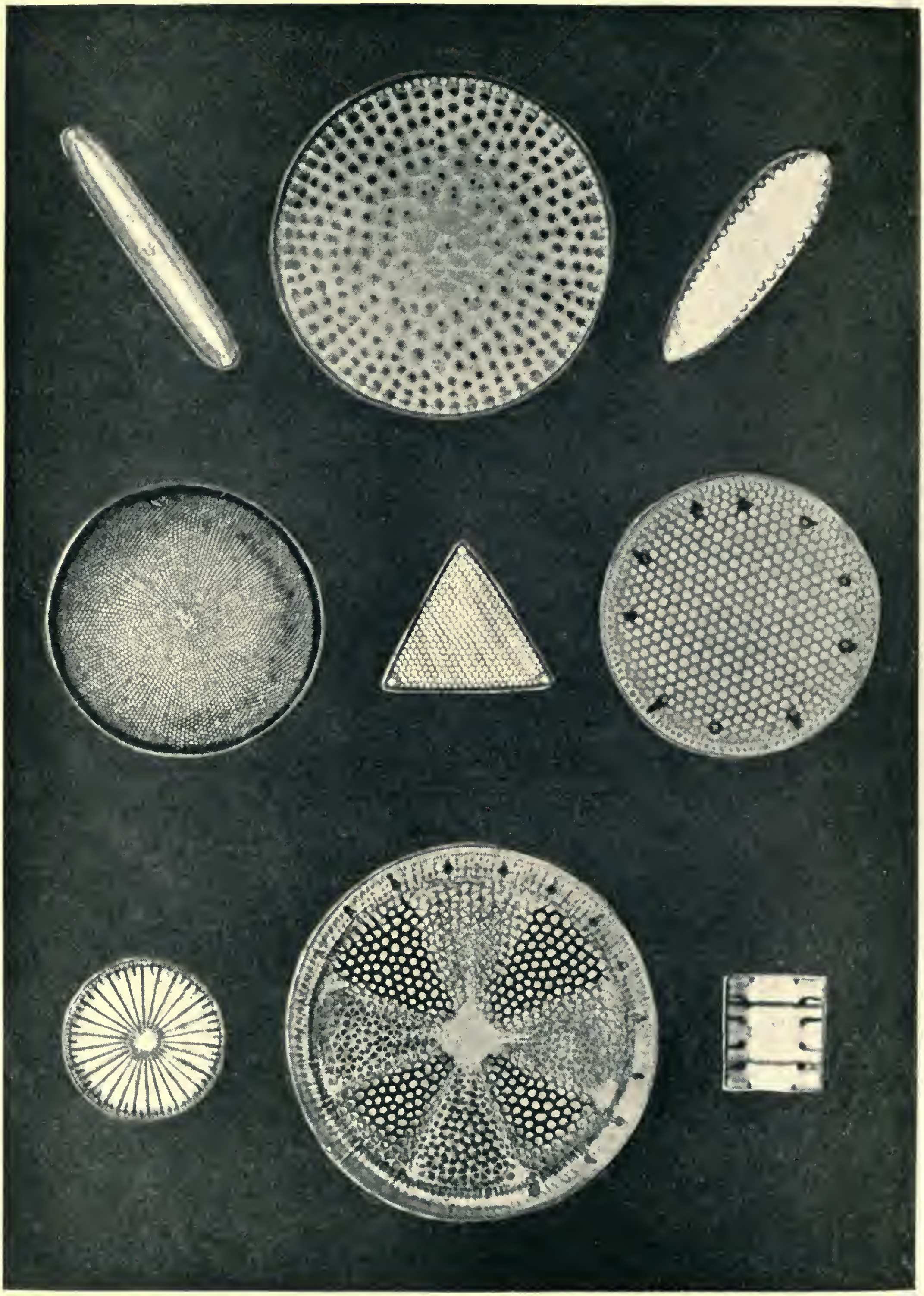
self on his legs or arms, stands there with the victim tightly gripped, and calmly pulls and pulls. We could not open a healthy oyster with our fingers, but the starfish manages to do it. The continual steady pull of the starfish is too much in the end for the oyster, and he gives in, faint and beaten, lets his shells come apart, and the end is an oyster lunch for master starfish. There is another terror of the oyster and the mussel in the common whelk. The whelk takes his stand on the shell of an oyster. He does not ask to be let in; he does not pull the oyster open. He rasps his way through, and the microscope tells us how he does it. That great file, with its cruel hook-like processes, which makes its startling appearance beneath our glass, is simply part of the tongue of the whelk. It is a living rasp, and with it the whelk grinds its way through the solid shell of the oyster to get at the soft body within.

The whelk's tongue has a rival in one of its tiny neighbours, the male sea-spider, which reveals the nicest of instincts to us by carrying about not only the eggs the mother spider has laid, but the young ones themselves, for their first sea-bath. He loves to see his children round his table, and our microscope reveals him to us in the act of gladdening his heart with this great happiness. We will leave him to his nursery cares in the strange world beyond our senses, opened for us by the microscope.



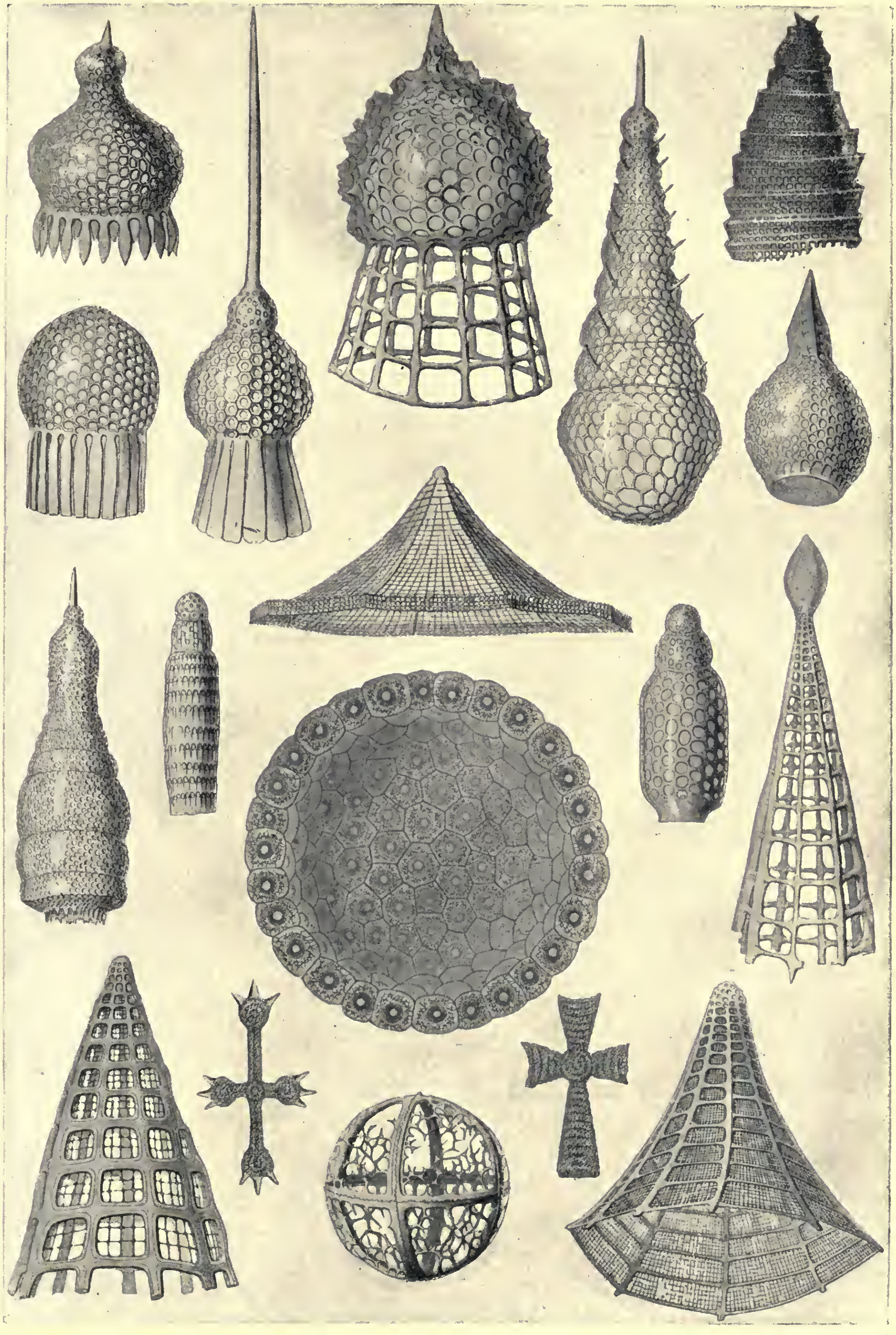
THE ASTONISHING STRUCTURE OF A JELLYFISH ABOUT THE SIZE OF A CANADIAN FIVE-CENT PIECE

INVISIBLE SPECKS THAT FLOAT IN THE SEA



THE ASTONISHING APPEARANCE OF THE SHELLS OF DIATOMS—THE TINY FLOATING OBJECTS IN SEA-WATER—AS SEEN UNDER THE MICROSCOPE

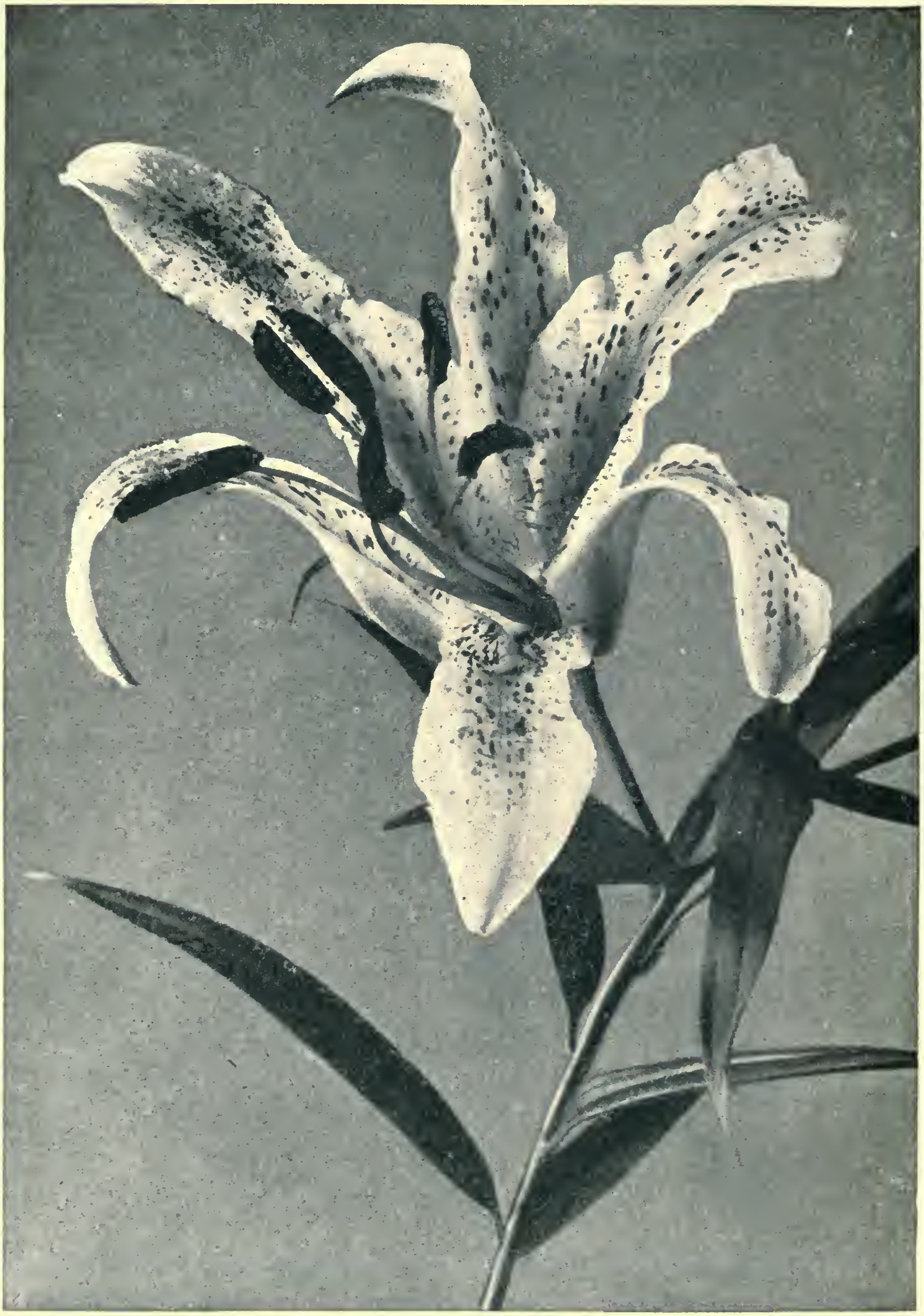
THE MARVELLOUS TEMPLES OF THE OCEAN BED



THESE WONDERFUL DOMES AND SPIRES AND MINARETS WERE BUILT IN THE SEA BY TINY CREATURES CALLED RADIOLARIANS, AND ARE SO SMALL THAT MILLIONS OF THEM WOULD GO INTO A TEA-SPOON

THE FLOWERS OF SUMMER

THE FAMILIAR GLORIES OF OUR GARDENS IN THE SUNNY DAYS OF SUMMER



Golden-rayed Lily. This beautiful flower, which has come to us from the East, is one of our most striking garden blossoms. An old superstition said that a family's health depended on the golden lilies in the garden, and great care was taken of them on this account.

THE WONDER OF THE FLOWERS

How many of us have thought of the wonder of the coming of the flowers? Perhaps the little baby sees it when he first looks about him with wondering eyes, and tries to grasp the blossoms in his little hands. But the rest of us have seen them come every year. We know we shall have them with us every summer, and, because we know them so well, we forget that their coming is a wonder as well as a joy.

Let us stop to think for a minute. Every plant, you know, has a flower, even the great trees and the tiny grasses at our feet. But the flowers fade and the fruits take their place. Then at the proper time the fruits fall to the ground, and the seeds are buried and sleep through the long winter. But when the sun begins to warm the cold ground they commence to grow and send roots down into the dark earth and shoots up to the bright sunlight, and soon the baby plants appear, each to grow just like the parent plant.

You know, of course, that all our garden flowers have sprung from wild flowers, and have reached their great beauty by cultivation. They have, as it were, been put to school. They have been carefully watched and tended, and have not been allowed to get bad habits. If they were allowed to grow as they pleased, many of them would fall back and become weeds, just as children who are untaught, or are permitted to have their own way, may grow to be very unpleasant people.

We all love flowers. Rich and poor alike, we want them about us—from those who go to a florist's and order them in abundance, to the "white wings" who carefully picks a stray blossom from the ash-can and sticks it in his buttonhole.

If we would get all the joy possible from our flowers, we grow them ourselves. We must dig the ground and dress it, smooth the beds and get them ready for the seeds to grow; then in the bright spring days we put the seeds in the ground and cover them over with the damp earth—though it takes a good deal of faith to believe that the bright flowers can come from those little dark brown seeds, some of them no bigger than grains of dust.

Then comes the eager search each day for some appearance of growth, and the gladness of seeing the first little spikes of green thrust up like fairy swords to greet the sun. How we watch the growth of the sturdy stems and the unfolding of the tender green leaves! But, as well as watching, we must work: we must water our plants in the dry weather so that the roots may be able to carry food up from the moist ground to the tiniest, topmost leaf and the little budding flowers. We must pull up weeds that they may not choke our plants, and keep away insects that are bad for their growth.

While we are waiting for our flowers to grow from seeds we may have earlier flowers. Many flowering plants grow from bulbs as well as seeds. These bulbs are special roots thrown out by the plant when it has finished flowering. They are unlike the regular roots, for they have little sprouts hidden in them all ready to grow up into new plants and give us flowers long before the seeds can possibly grow into roots and leaves and become grown-up plants. The bulbs live in the ground all winter, so if we put them in our beds in the autumn, and tuck them up snugly with a good, deep covering of earth, we shall have a brave showing of lovely flowers in the spring-time.

Every boy and girl who lives in the country can have a garden and learn the pleasure there is in watching growing things. Many a city child, too, can have a flower-bed, cover the fences with vines, and plant ferns in the shady corners. Gardening, you know, is really great fun, and not half such hard work as many of the other things that we delight in doing. So let each of us give a little of our playtime to this fascinating task, and when summer comes we shall be repaid for all our faith and hope and work, for our garden will bloom with beauty and we shall have learned the joy and wonder of the coming of the flowers.

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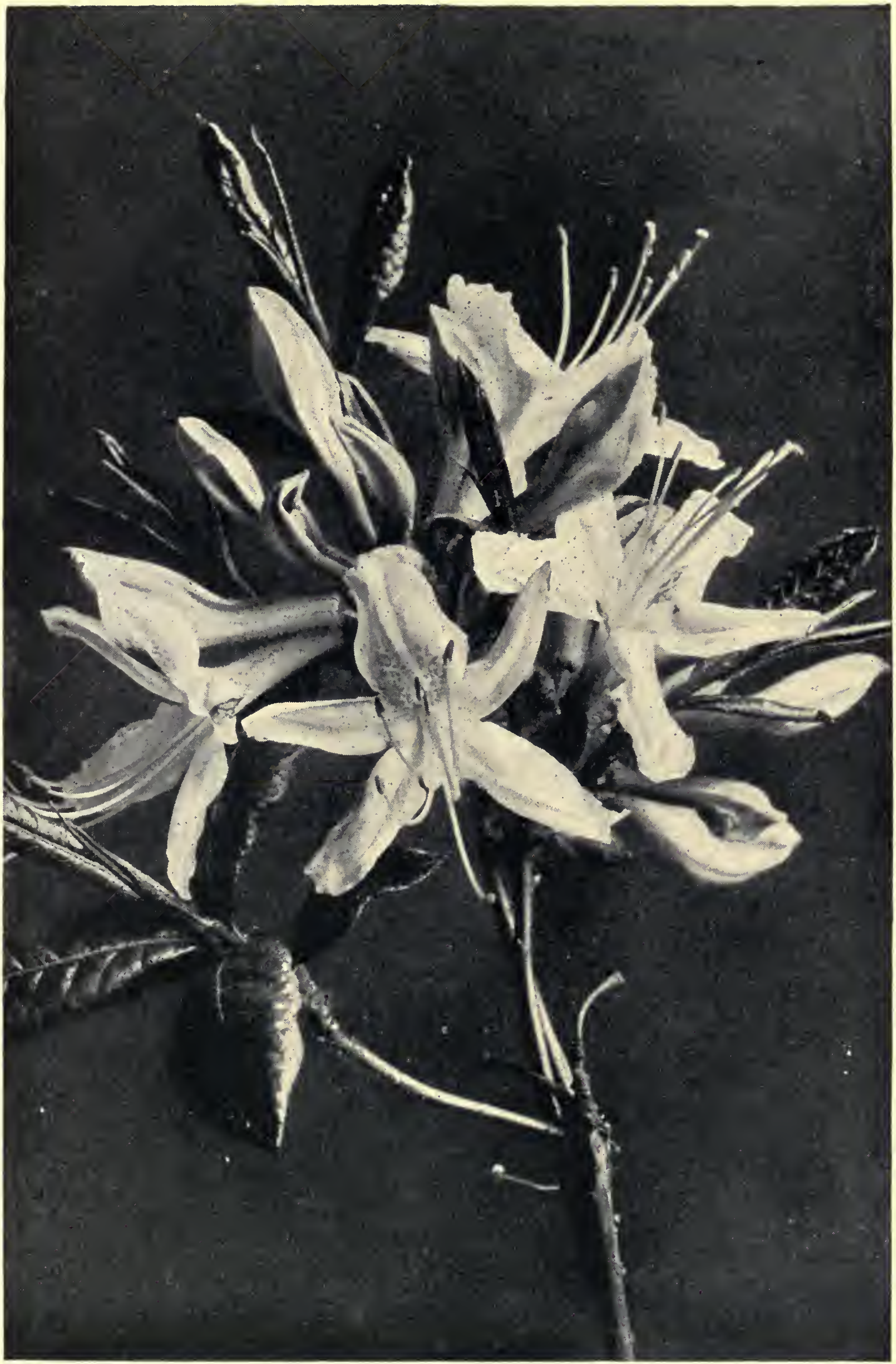
Gladiolus. The name means a little sword, and refers to the shape of the leaves, but sometimes the flower itself is called the sword lily. It is very beautiful, and has the great advantage of being quite easy to cultivate in dry and sunny situations in a wild garden.

Crested Cyclamen. Our florists have produced some very beautiful cyclamens, like that shown here, and the lasting character of the flowers makes them a great favourite with us. But in the north of Italy the pigs feed on the round, flattened cyclamen bulbs.

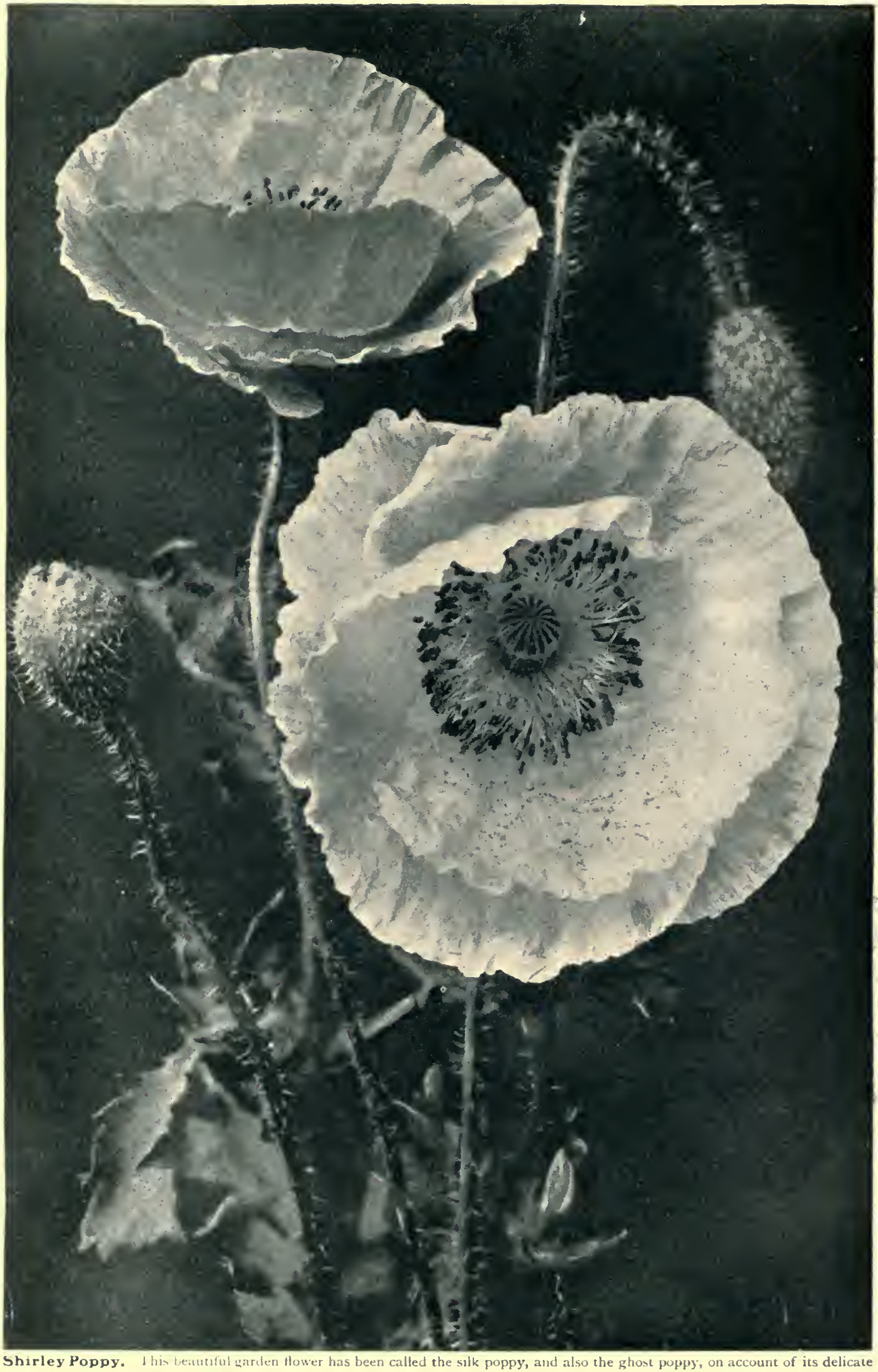
Begonia. These beautiful flowers are now much used in garden borders, partly because of their brilliant colouring and partly because they are unaffected by heavy rains which spoil geraniums.

Annual Chrysanthemum. Grown in masses in beds or borders and also in window-boxes, these flowers make a magnificent show, with their striking splashes of crimson and purple.

Rhododendron. A row of rhododendrons in full bloom is a magnificent sight in any garden or shrubbery. Some of our finest varieties were brought from India, where they grow wild in the mountainous districts. The rhododendron has evergreen leaves. Some beautiful varieties are natives of our own mountain regions.



Azalea. This relation of the rhododendron is a native of Asia, but it is now one of the glories of our country gardens in early summer. It is very handsome, but the whole plant is poisonous, and honey collected by bees from its flowers is said to cause delirium.

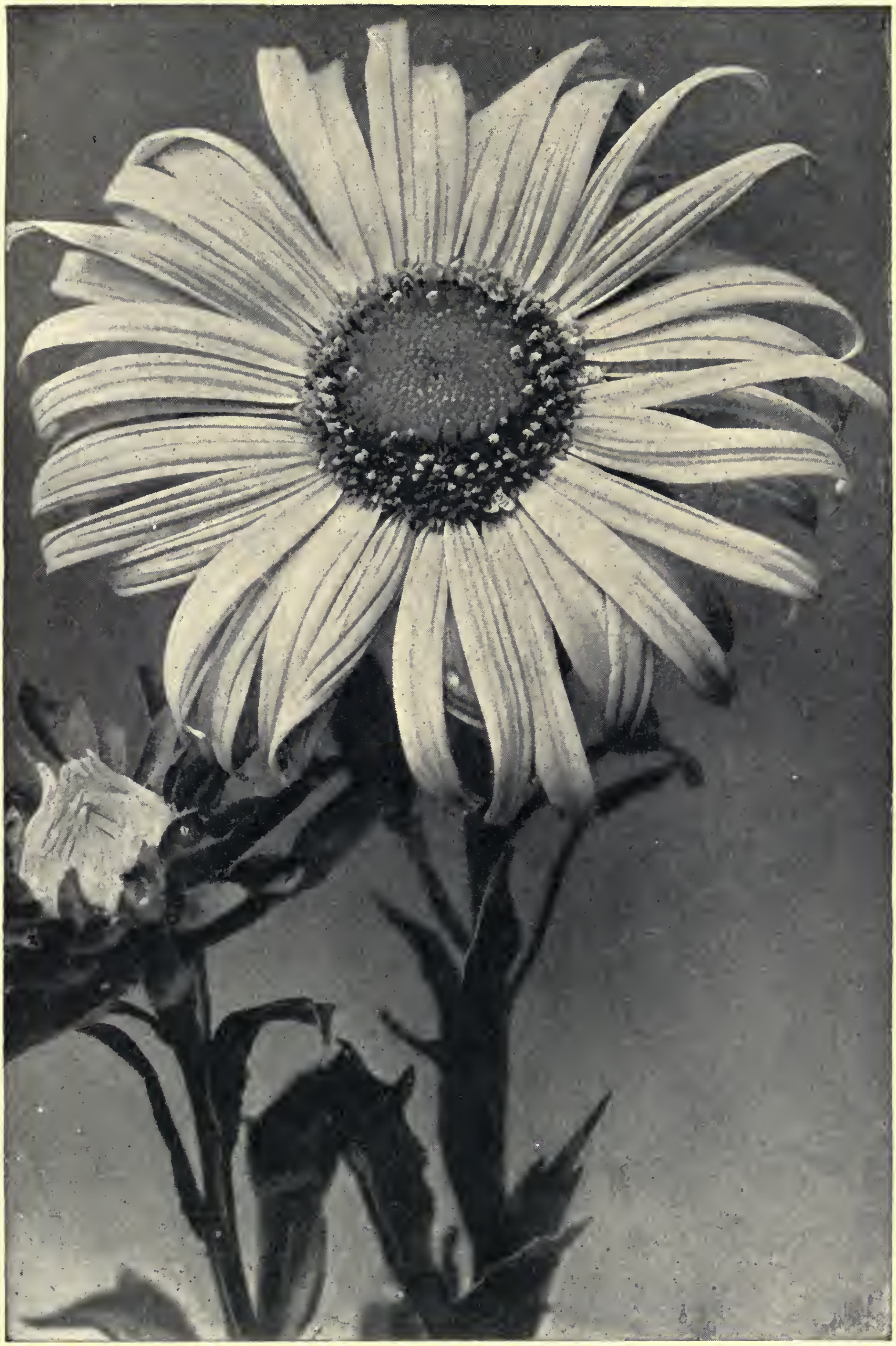


Shirley Poppy. This beautiful garden flower has been called the silk poppy, and also the ghost poppy, on account of its delicate filmy texture. The shades of colour in various flowers are countless. At the sides of a grassy walk or path they make a delightful show.

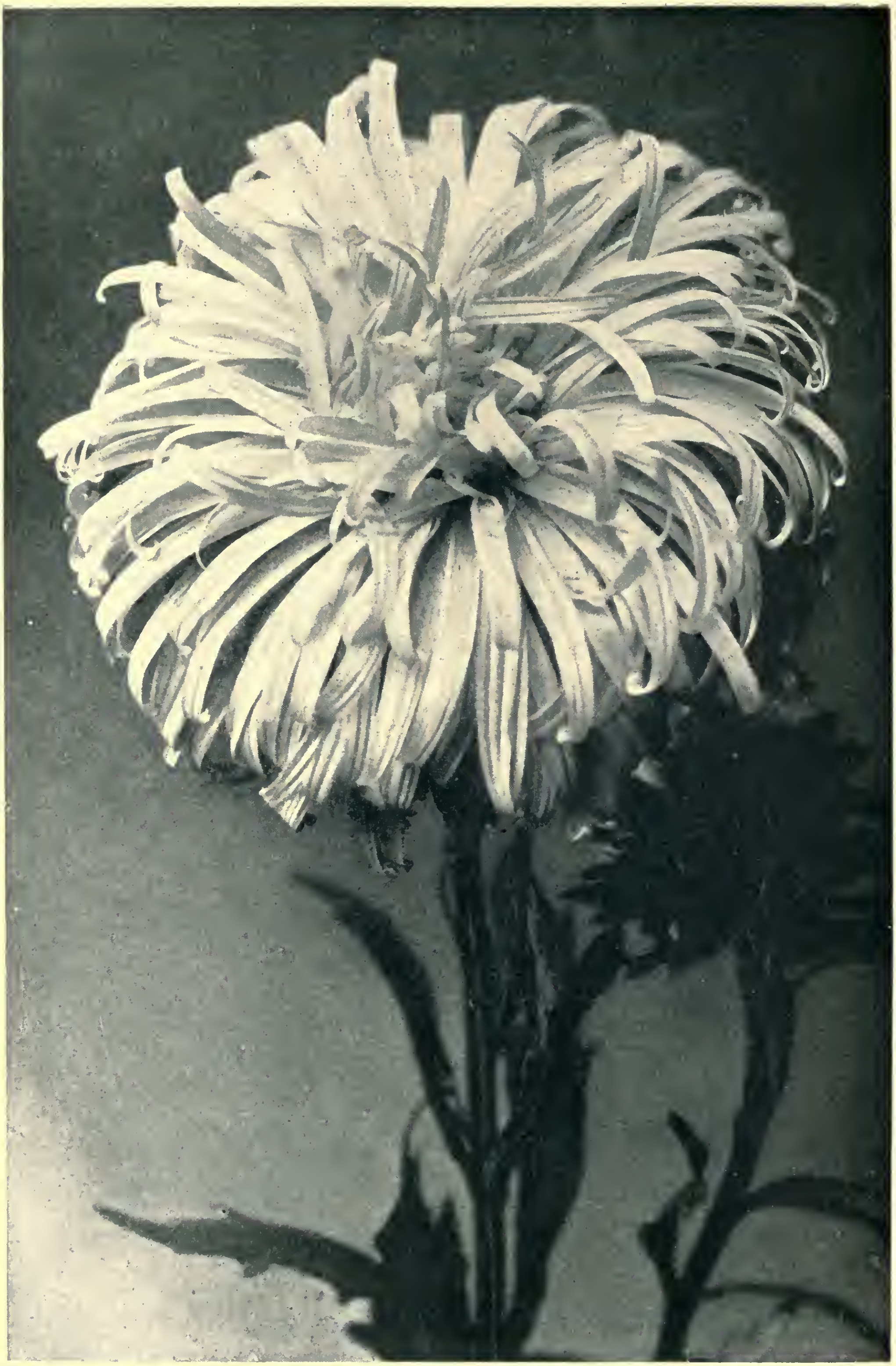
Cosmea. The name means an ornament, and certainly these early-flowering cosmeas are an ornament in any garden or greenhouse The pretty, feathery foliage is well in keeping with the dainty flowers, and the plant will blossom right up to the early frosts of winter

Carnation. It seems strange that these delightful flowers should get their name in the same way as such unpleasant words as carrion and carnage ; yet so it is, for they all come from a Latin word meaning flesh, the original carnation being the colour of flesh.

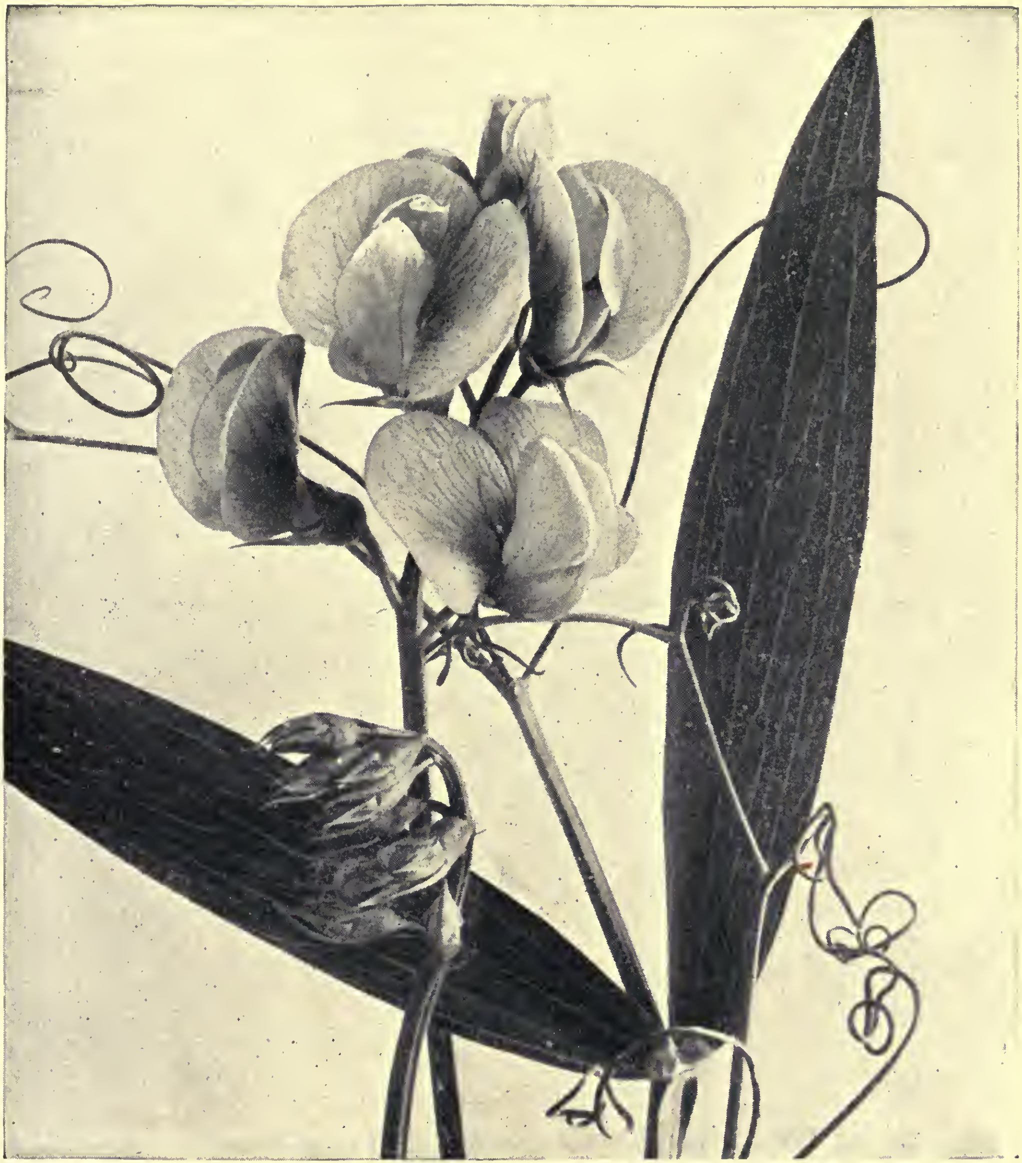
Dianthus. From its great beauty this was called the flower of God, which is the real meaning of its name. Yet it was a long time before florists troubled to cultivate the flower with any care so as to produce splendid varieties like this large-flowered dwarf dianthus.



Single Comet Aster. The name aster means a star, but in this choice variety the petals are so long and flowing that they suggested a comet to the cultivator, and he named the flower accordingly. Either in a bed or for indoor decoration it is very beautiful.



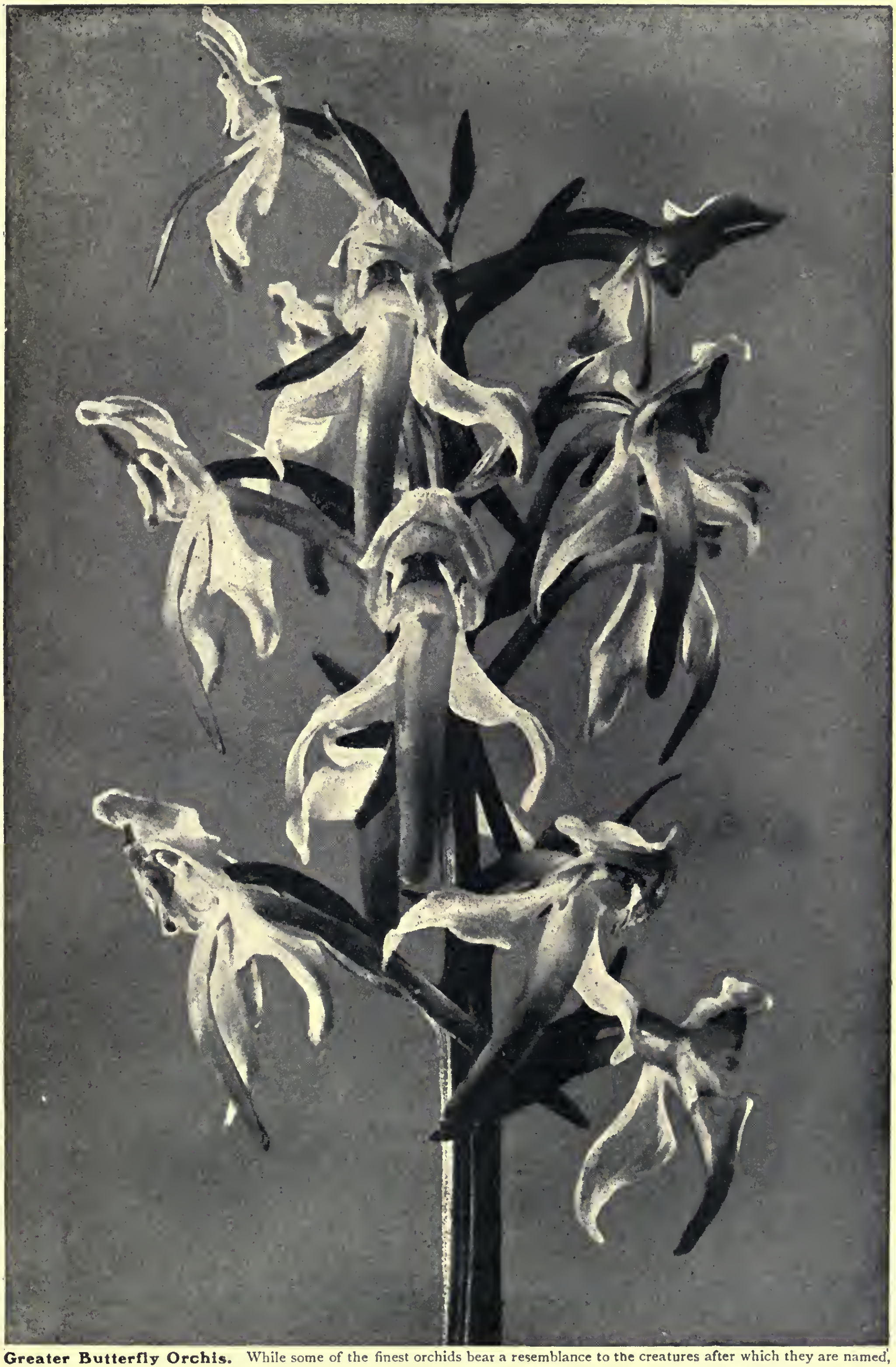
Plume Aster. A glance at this picture will show how well the name fits the flower. With its flowing, feathery petals, there is, indeed, very little of the original aster about it, and we might almost think we were looking at some particularly fine chrysanthemum.



Everlasting Pea. There are various kinds of everlasting peas, this one being the narrow-leaved variety. It has rosy-pink flowers with greyish-green leaves, and is found wild in rocky thickets. It is a cousin of the sweet pea.

Calceolaria. The magnificent calceolarias that we now see at all flower-shows, and that we are able to grow in our gardens, are very different from the simple calceolarias of an earlier day. It is impossible from a picture like this to get any real idea of their beauty.

Double Fuchsia. Country people speak of the fuchsia as the lady's eardrop, because it resembles a drooping earring. The original plant, named after the German botanist Fuchs, has been developed into a thousand varieties, of which this double fuchsia is one.



Greater Butterfly Orchis. While some of the finest orchids bear a resemblance to the creatures after which they are named, it must be owned that the greenish-white flowers of the interesting butterfly orchis have very little likeness to any known butterfly

Rose. It is not surprising that the whole world of literature has paid willing tribute to the rose as the queen of flowers. No one could now say how many varieties of the rose have been produced by the florist, all of them a delight to the eye and rich in Nature's loveliest perfume. Yet they own the common wild rose as their ancestor. This picture shows the beautiful Jersey rose.

THE IMPRISONED BUD AND HOW IT IS RELEASED

NO matter what else may be sacrificed to frost, that plant which is to exist during the winter season tries to keep safe a certain living element which is concealed in what is known as a "bud." Those cells that are intended to grow on in the spring are protected from animals, from the weather, and from losing their moisture, as perfectly as possible, and in a number of wonderful ways. One of the oddest of these is that adopted by certain aquatic plants, which, floating at the surface of waterbodies in summer, at the approach of winter enlarge the leaves at the ends of their branches, forming large buds, or grow entire little rosette-like plants, attached to themselves only by stalks. The parent plants then sink with their brood, and during the winter they, or the stalks, rot away, releasing the buds, or young plants, which thereupon float to the surface before starting into growth.

Other water-plants, however, already more or less protected by the water above them, and the mud in which they are sunken, secure the safety of their buds as do those above the ground. Roots of nearly every perennial whose upper parts may have been stricken by frost, when dug out will show somewhere tooth-like, practically colourless buds, whose cone-shape and sharpened point enable them to pierce the rain-soaked ground in spring very readily. Some of these buds, as those of onions and lilies, are almost hidden by thick scales, which are really leaves and in which are stored reserve food-materials, upon which the hurrying young shoot in spring can draw without waiting for rootlets to grow. These are called bulbs, and human beings have learned to use the same food-materials, as they have those in the tubers of potatoes, wherein the buds are embedded as mere "eyes"; they have also discovered, to their cost, that some of these bulbs and tubers are provided with poisons for defence against the attacks of animals. But the clever animal, man, has actually utilised these also, deriving common medicines and poisons, as aconite, from them. Some of the bulbs, moreover, have papery overcoats of netted or membranous scales, which we see in the crocus and hyacinth.

Many a heap of faded and half-rotten foliage lying under the snow conceals and protects a winter-bud beneath it; but the stroller in winter fields is more apt to notice the pretty green rosettes of certain weeds that manage to survive the cold and be on hand to harass farmers in summer. All of them could be used as models of charming geometrical designs. In the exact centre of each reposes a bud, which is very often that of a flowerstalk, "and there it patiently sits and slumbers, how full of faith, informed of a spring that the world has never seen," ready to shoot up and crown itself with flowers.

Fruit growers soon learn to tell the difference between the bud which is going to produce flowers and that which will bring forth leaves only, but most of us only admire, like Thoreau, "the great yellow buds of the swamp pink, the round red buds of the high blueberry and the sharp red ones of the panicled andromeda." In fact, one may recognise, even in midwinter, many a tree or shrub by its buds alone. The beech is betrayed by its long, brown, sharp lances; the dogwood, by its upturned square parcels; the hickory by its great fat, aromatic, furry domes, and the willows by the "catkins, but half asleep along the twigs, under the armour of their black scales." The drooping catkins of birch and alder, in their winter rigidity, also proclaim their kind.

No one of these buds in all their varieties has any other protection against freezing, or the burning of a hot spring sun, than that given by the tough, hard, leathery or paper-like modified leaves that are wrapped so snugly around them that even with a knife it is difficult to remove the scales. These enveloping scale-leaves have no other work to do except to protect the tiny growing shoot, or the flower which is packed within ready to bloom the instant it gets a chance, so that they have no need for green growing tissue and are usually colourless or brown in tint, although they occasionally assume other tints. They prevent moisture, however, from passing either way, by their peculiar texture, and thus keep the bud moist and warm, and protected from alternate freezing and thawing. Even those paired basal parts of a leaf called stipules serve the same purposes, generally by acting as screens. The tulip tree, for instance, has boat-shaped stipules, meeting face to face

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like walnut-shell halves, which cover closely the shoot and form a sort of sealed cup in which it develops as in a greenhouse, for the stipules are as translucent as membranes. When the bent leaf straightens up and bursts through the cup, the stipules fall away.

John Burroughs notes that "When spring pushes pretty hard many buds begin to sweat as well as to glow; they exude a brown, fragrant, gummy substance that affords the honey-bee her first cement and hive varnish. The hickory, the horse-chestnut, the plane-tree, the poplars, are all coated with this April myrrh. That of certain poplars, like the Balm of Gilead, is the most noticeable and fragrant. No spring incense more agreeable." It would be a little more exact to say that this varnish, a mixture of mucilage and resin, called balsam, covers the bud during the whole winter; at least in the case of the horse-chestnut. Like the silken or woolly nap lining some bud scales, and the masses of chaffy scales on the closely rolled croziers of fern fronds, it assists in regulating moisture and temperature. Very young buds, furthermore, are sometimes capped, as it were, by the hollow sheathing bases of leaves that have preceded them.

Certain buds are furnished with spicy oils and flavours that were presumably given them to discourage birds and animals intending to forage upon them, but which have given them commercial value. It is due to this precaution that we have cassia and cloves for spice, and pungent pickled capers for our mutton. It is not without reason that buds are thus rendered burning and disagreeable to birds and animals, for grosbeaks and partridges strew the ground with scales, showing where they have ripped out the hearts of winter-buds, and the great crimson-coated buds of the striped maple are so often fed upon by deer that the tree is called "moosewood."

Protected, or imprisoned, by all these means of defence, we may find either a perfectly-formed, although microscopic flower ready to expand when the rising sap and warming sun warn it of the time, or a little growing shoot with foliage. Both are still further fortified against the loss of moisture, especially when the guardian scales have gone, by the curious manner in which the very young petals or particularly leaves are packed into their lockers by folding or crumpling. A cut across any large bud, such as that of the lilac, will show this plainly. The tiny leaves are plaited like a fan, or have the edges rolled like a scroll, or are cleverly "wudged-up," or are folded along their midrib, hanging like curtains, or are placed together like the leaves of a book. As the scales seared by the warm breath of spring, and pushed outwards by the swelling shoot within, fall away, the young foliage is prevented by all these folds from exposing too much of its tender untried surface to doubtful weather. Varnish and hairiness on these unfolding leaves protect them as they did the resting bud; and it may be stated "that, with the exception of a few crumpled forms, all young foliage-leaves when they emerge from the bud-scales, or from between the cotyledons, or as they force their way through the soil into the light of day, are so directed that their blades are not horizontal. In this first stage of development, indeed, the green transpiring, but still delicate portions of the leaf have always a vertical position." This of course tends to keep them out of the direct rays of the sun, and some of them, even when hardened to sunshine, fold up and droop at the approach of cool night or rain. Moreover, the infant leaves are often so arranged that the main ribs are brought close together, thus forming a sort of roof defending the tender folds of tissue hanging between them as the sticks of a fan ward off blows from the paper.

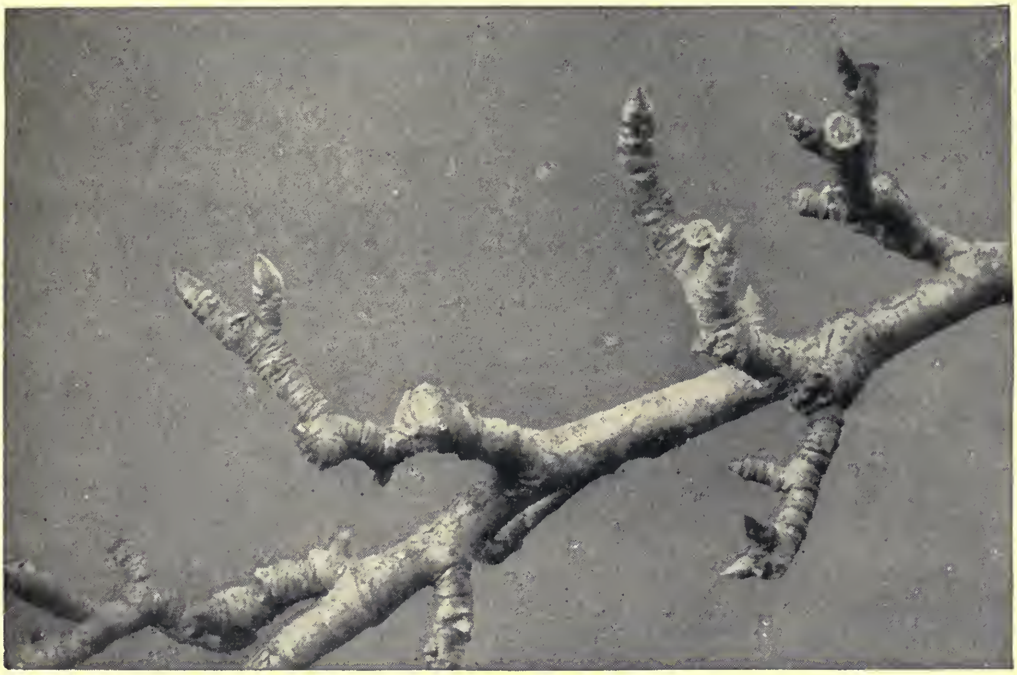
The chlorophyll or growing element of the emerging leaves or petals is said to be itself protected by a pigment which gives the pink or purplish tinge to the outside of bud and young foliage; combined with wooliness it is very conspicuous in oak and grape leaves.

"The bud scales begin to drop in April, and by May day the scales have fallen from the eyes of every branch in the forest." So writes Burroughs, "In most cases the bud has an inner wrapping that does not fall so soon. In the hickory this inner wrapping is like a great livid membrane, an inch or more in length, thick, fleshy and shining. It clasps the tender leaves about as if both protecting and nursing them. As the leaves develop, these membranous wrappings curl back, and finally wither and fall."

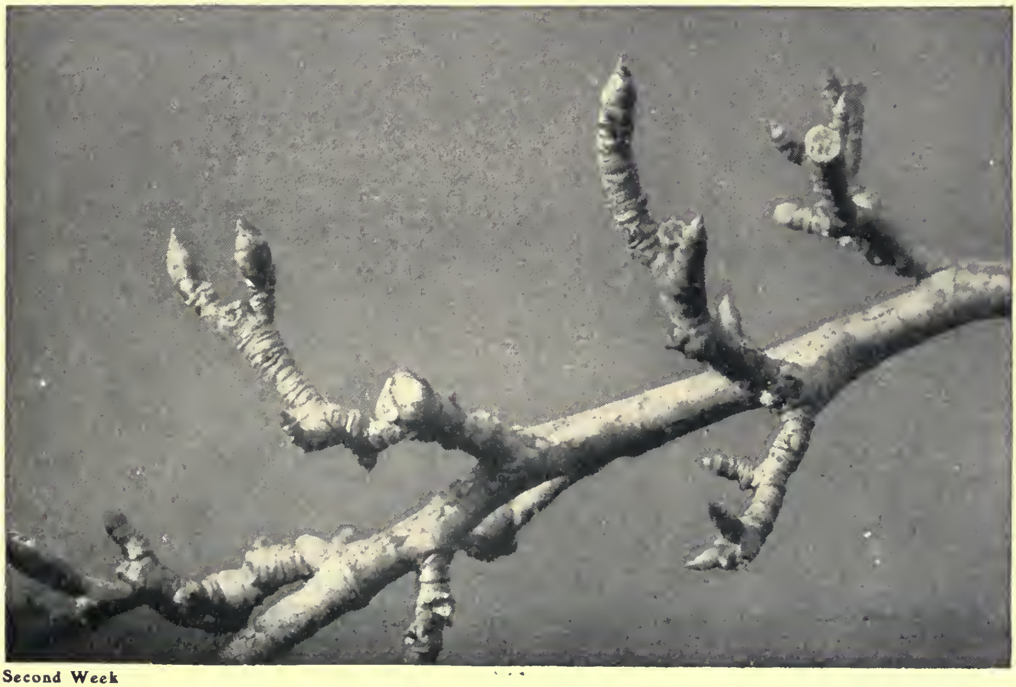
NATURE MAKES HER PROMISE

THE UNFOLDING OF THE BLOSSOMS WHICH ARE NATURE'S PLEDGE TO THE WORLD OF THE FRUITFUL SUMMER THAT WILL COME

A PICTURE-DIARY OF THE LIFE OF A PEAR BLOSSOM



First Week



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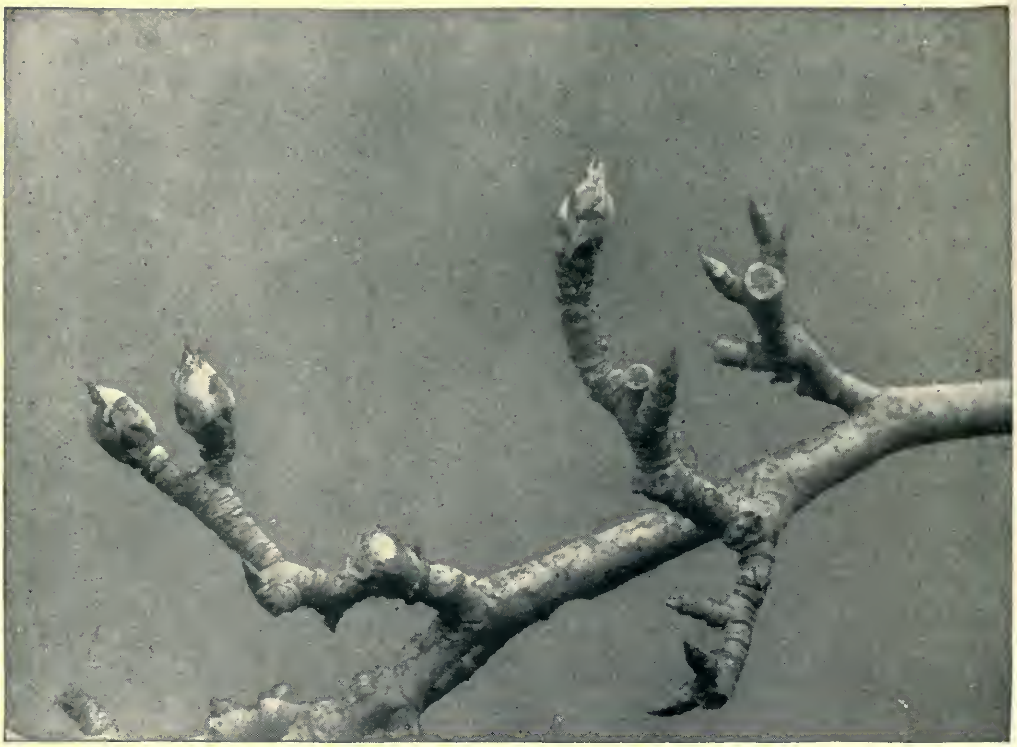

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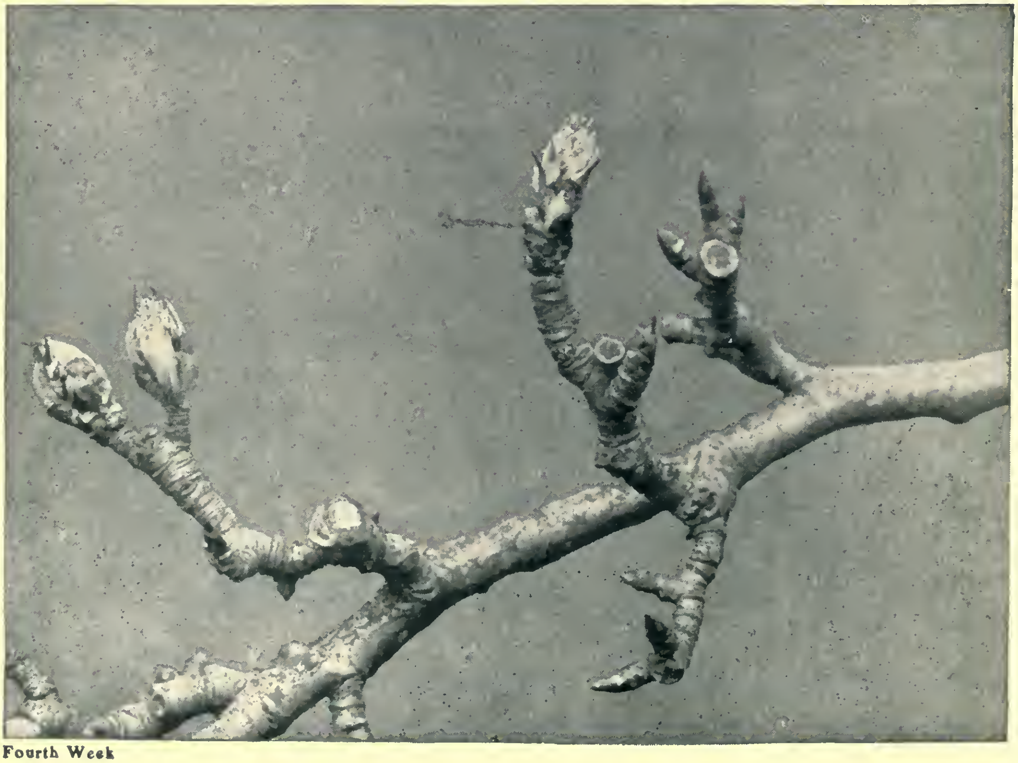

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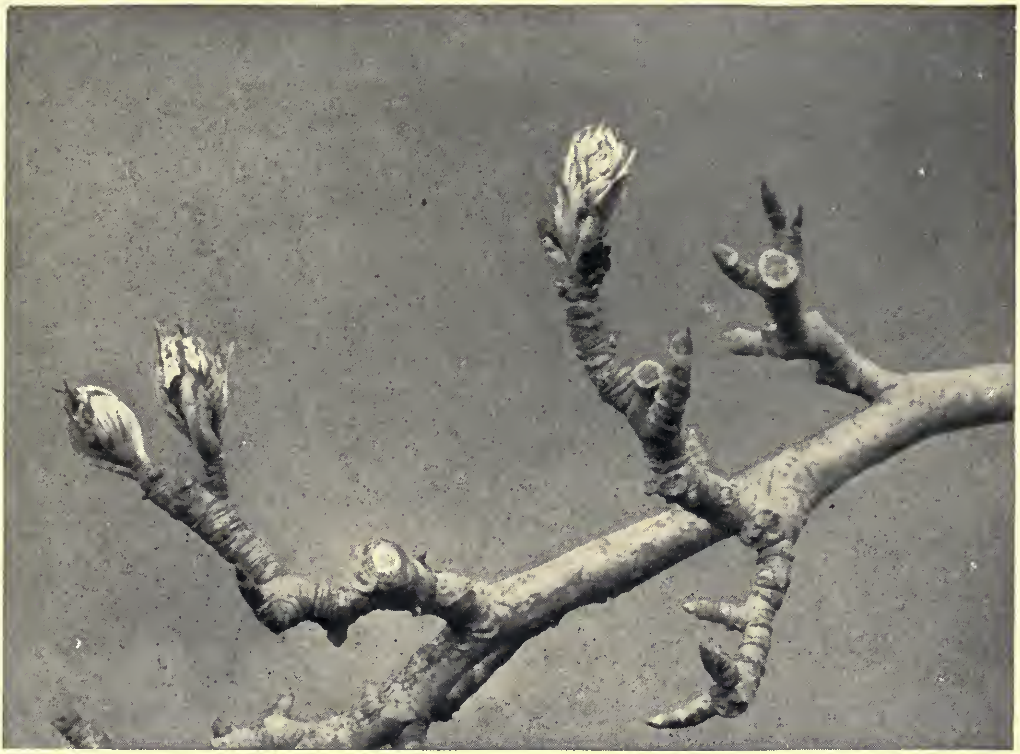
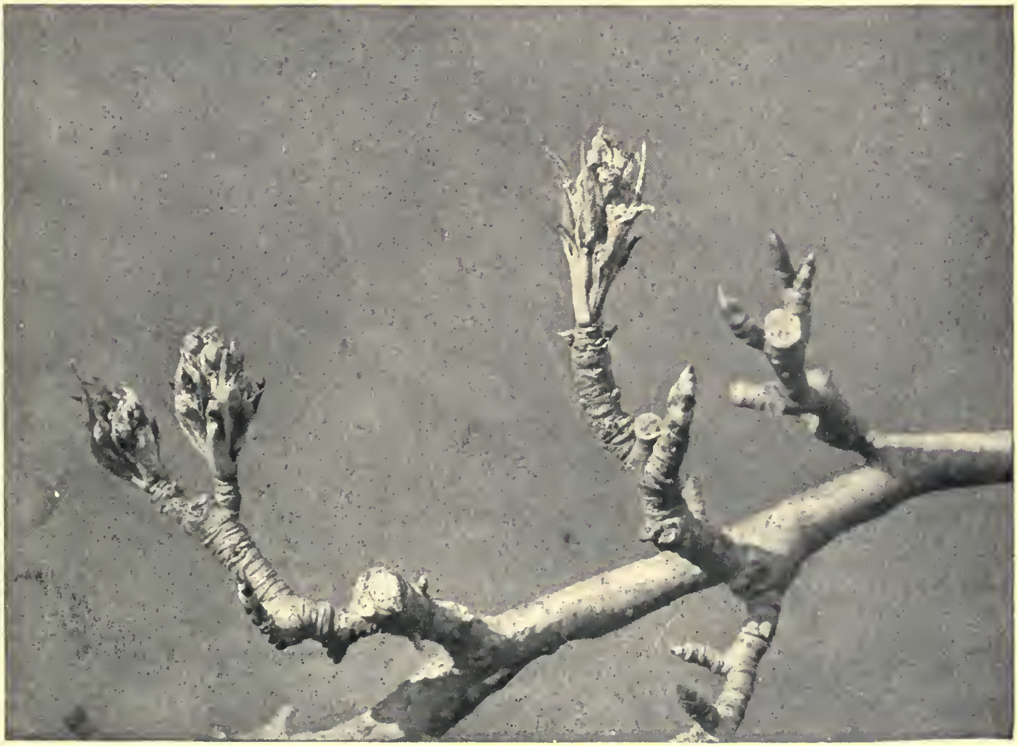
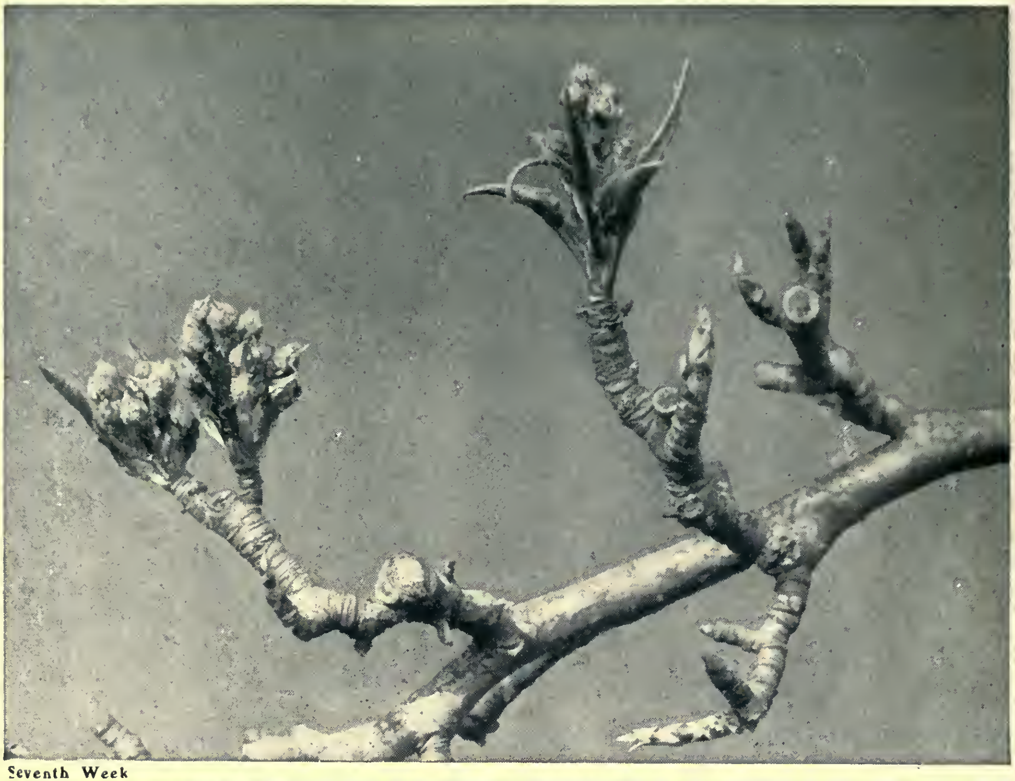


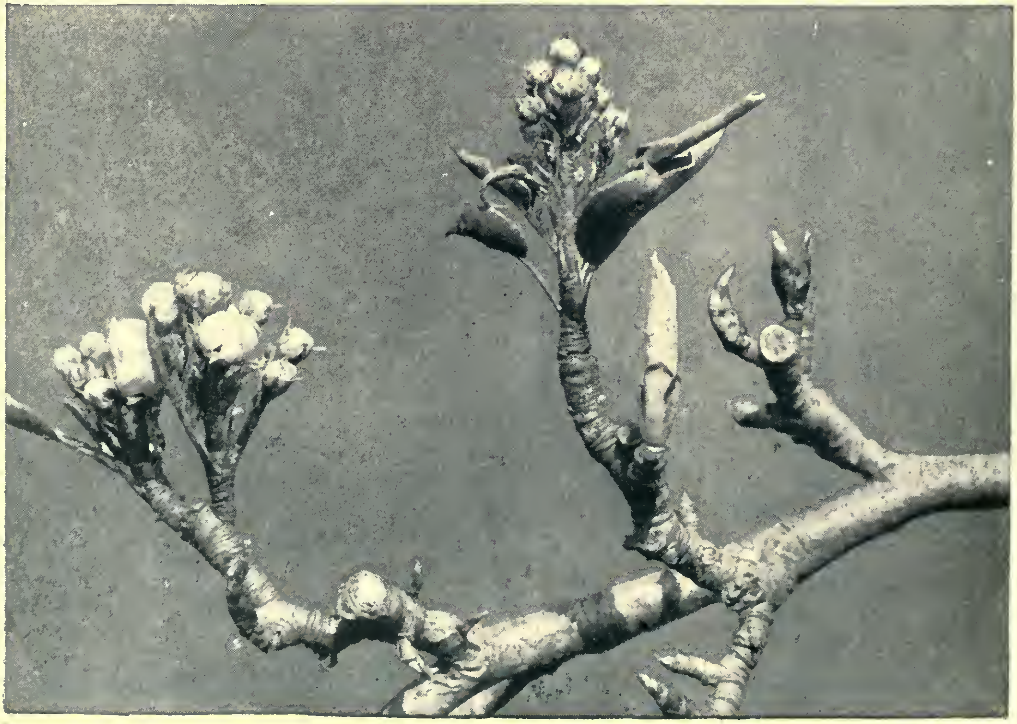
Fifth Week



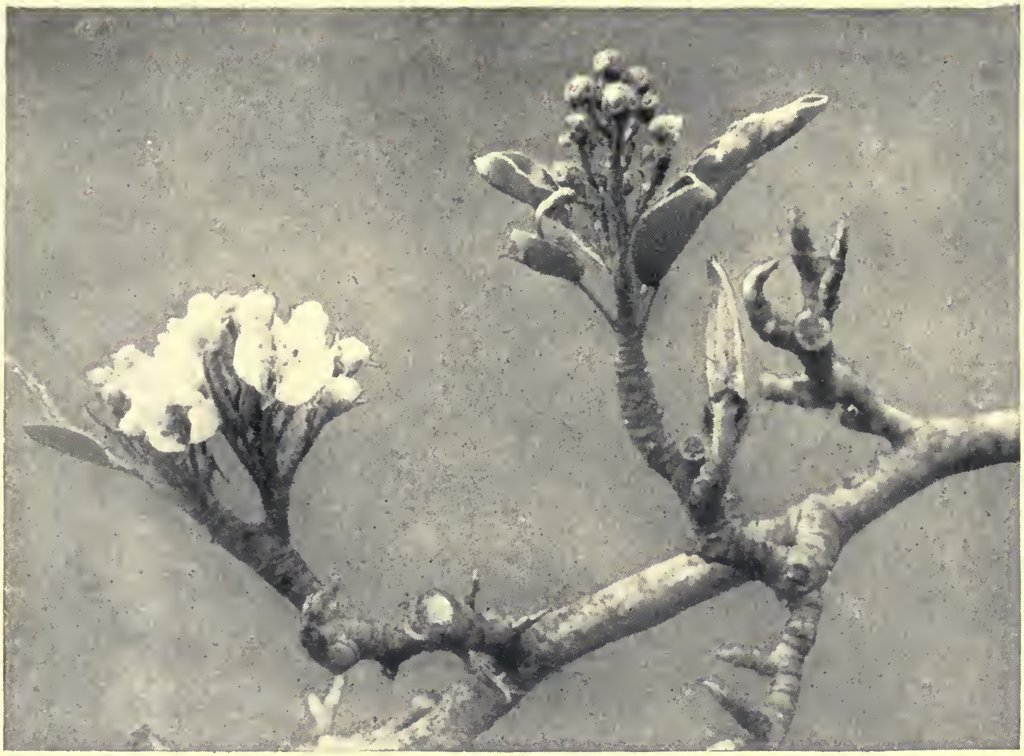
Sixth Week



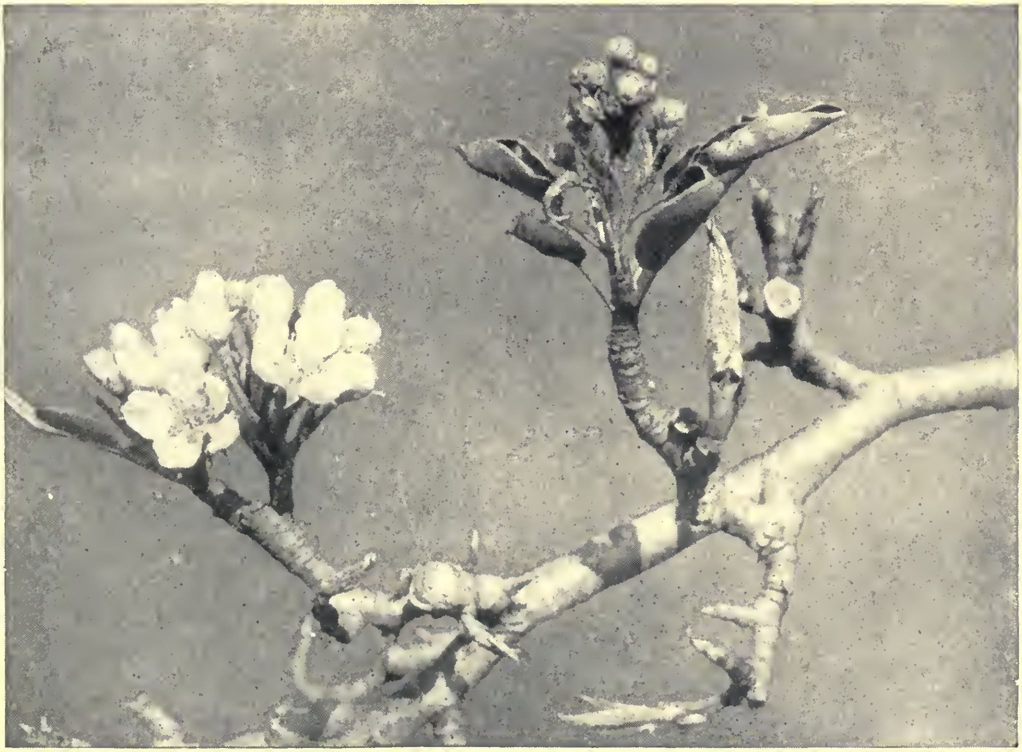
Seventh Week



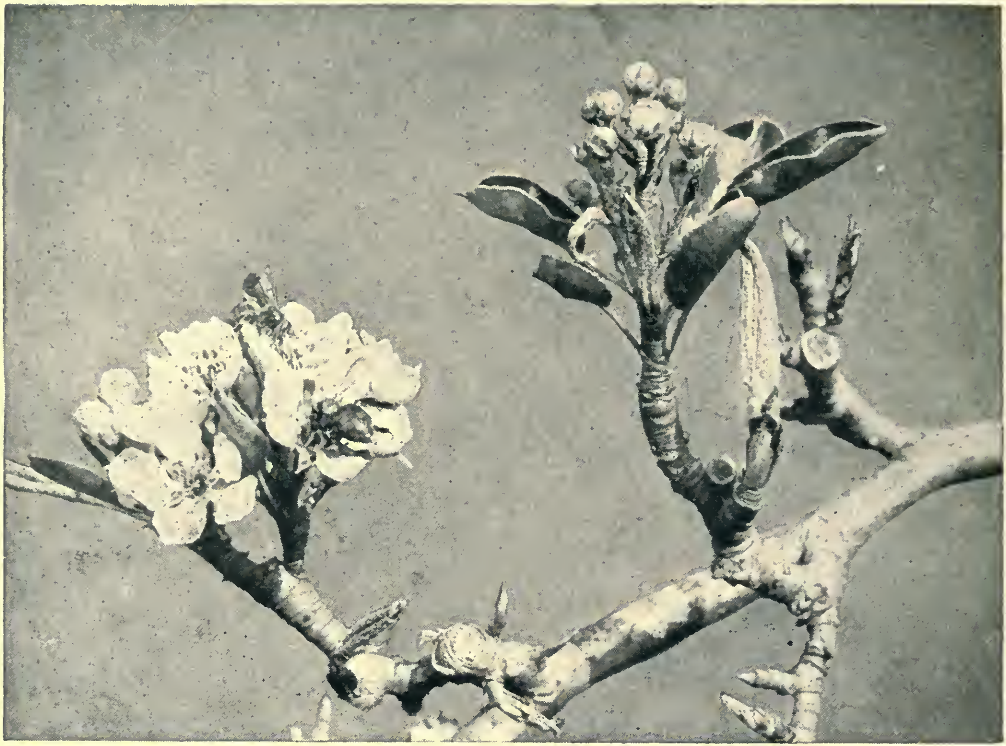
Eighth Week



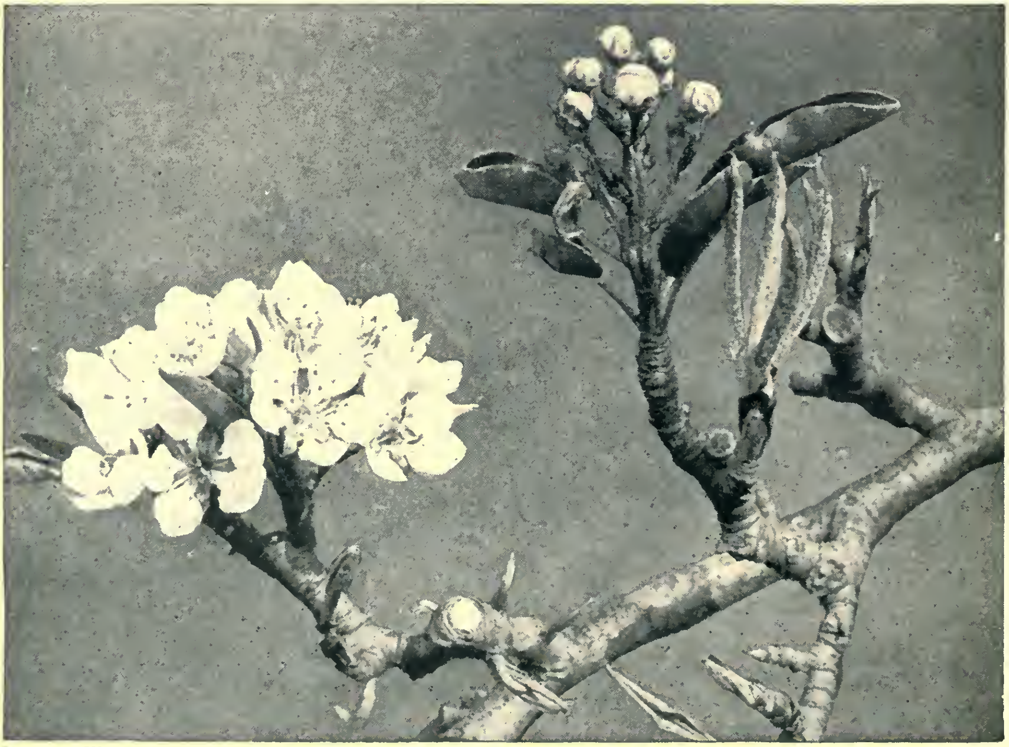
Ninth Week



Tenth Week



Eleventh Week



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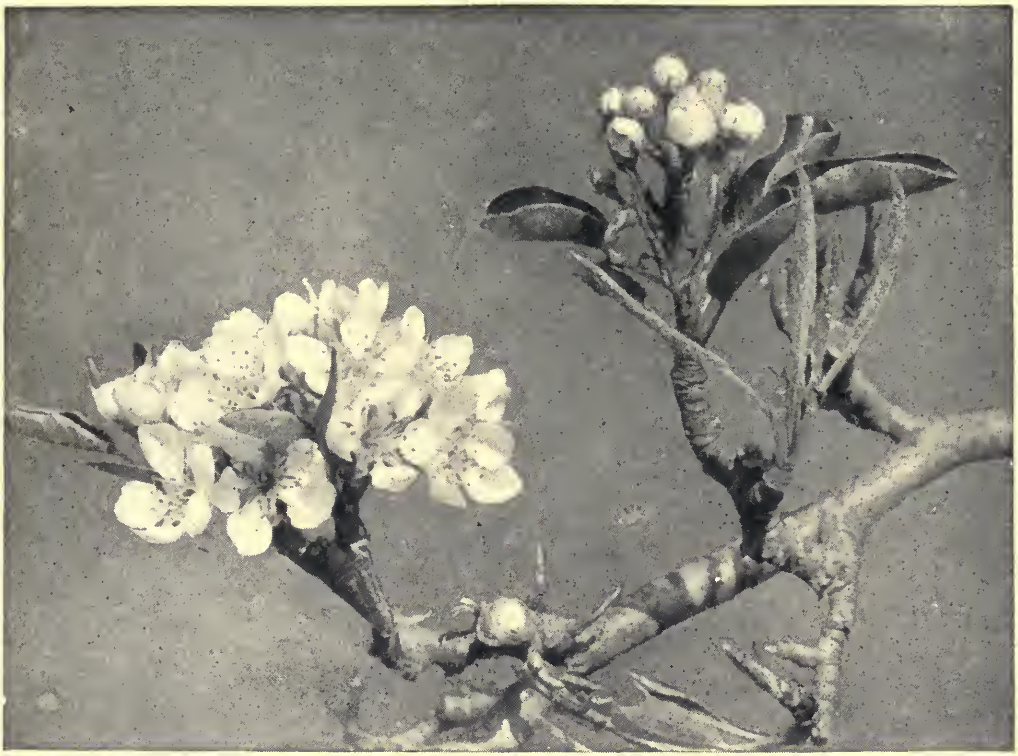

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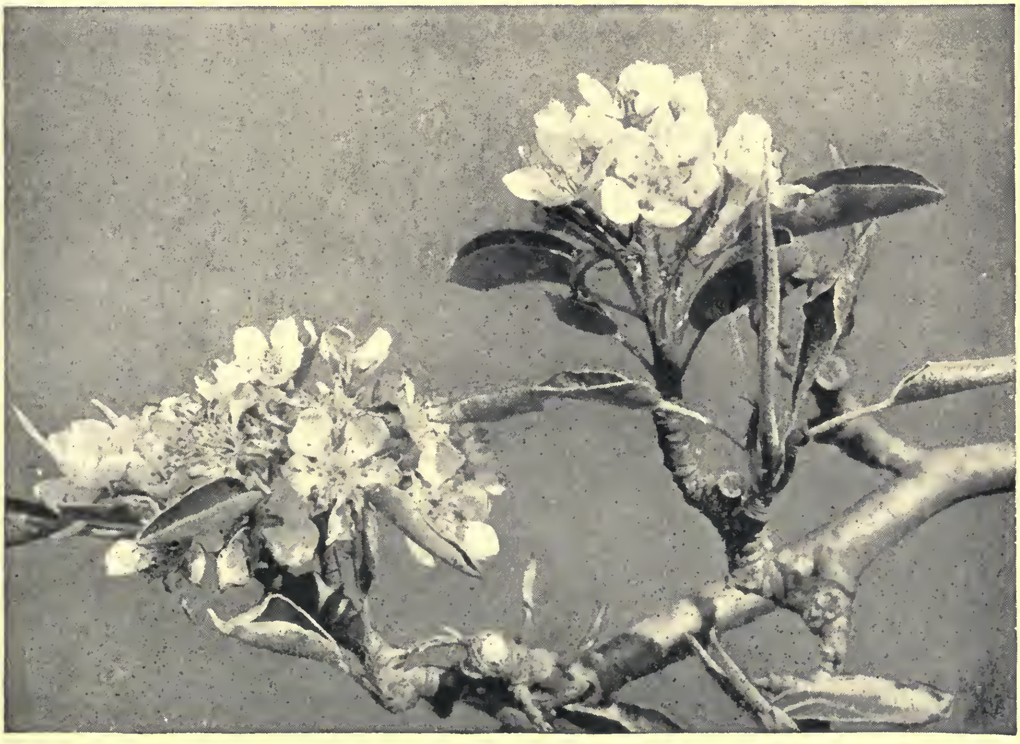
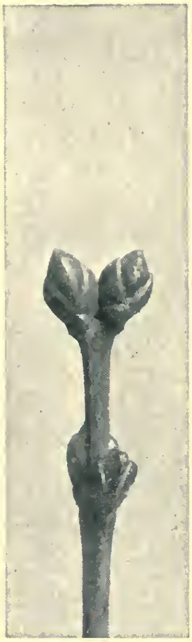


Twelfth Week

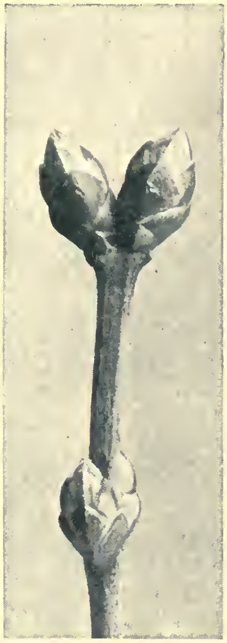
THE UNFOLDING GLORY OF SPRING

A PHOTOGRAPHIC DIARY OF FIFTEEN WEEKS OF THE LIFE OF A BEAUTIFUL THING

HOW A SPRAY OF LILAC COMES INTO THE WORLD



First Week



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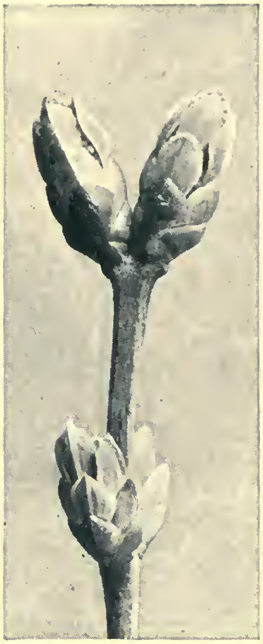

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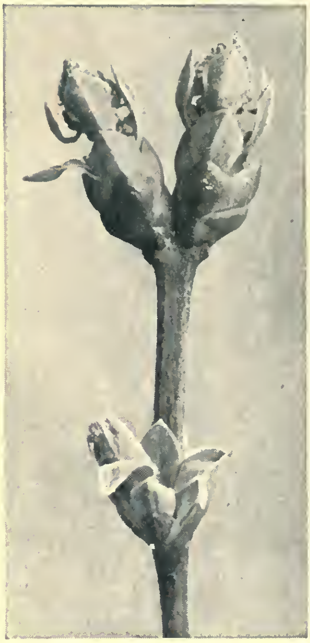

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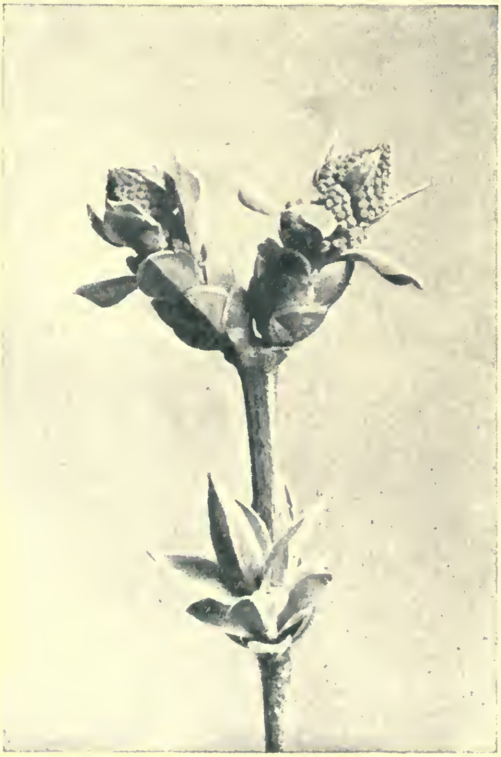
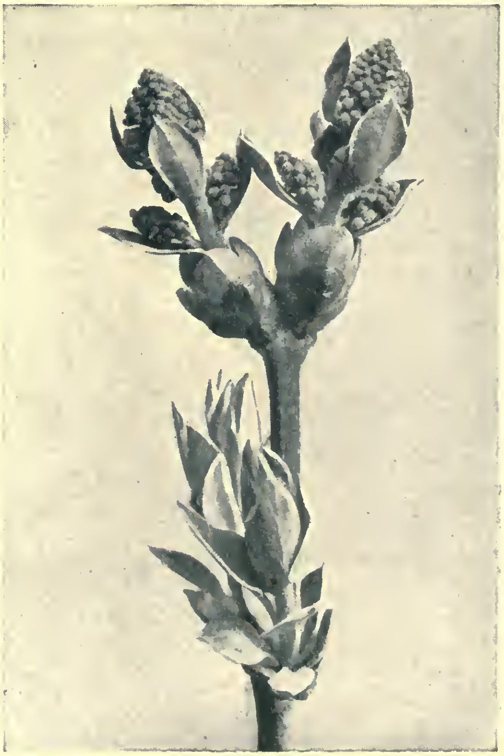


Fifth Week



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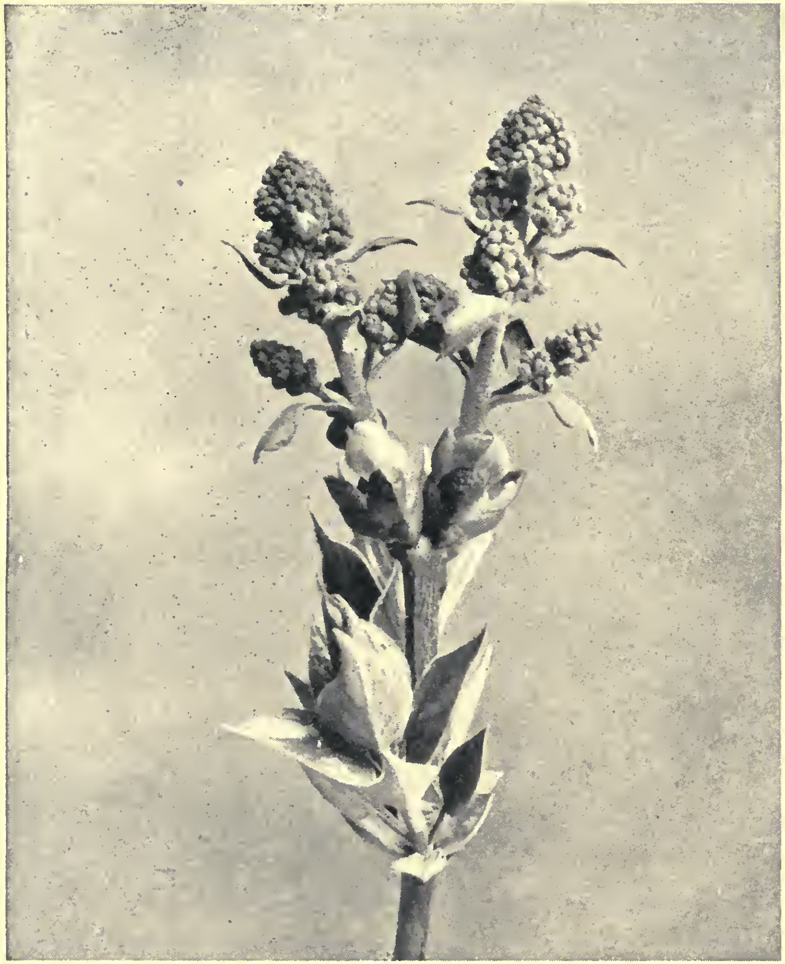
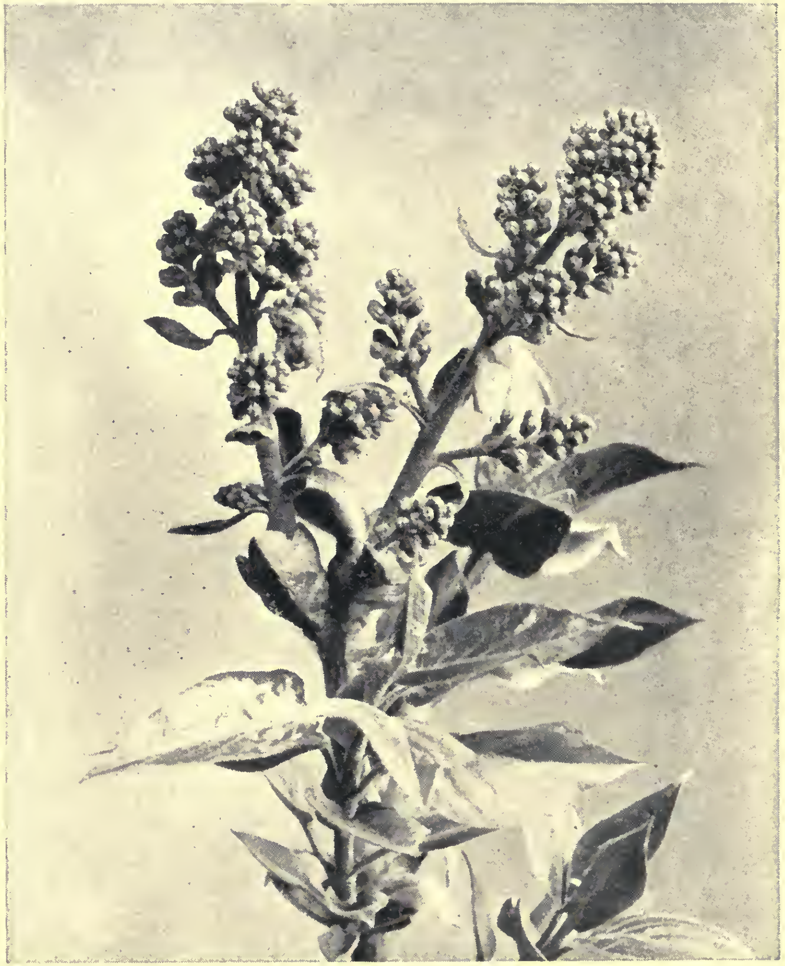
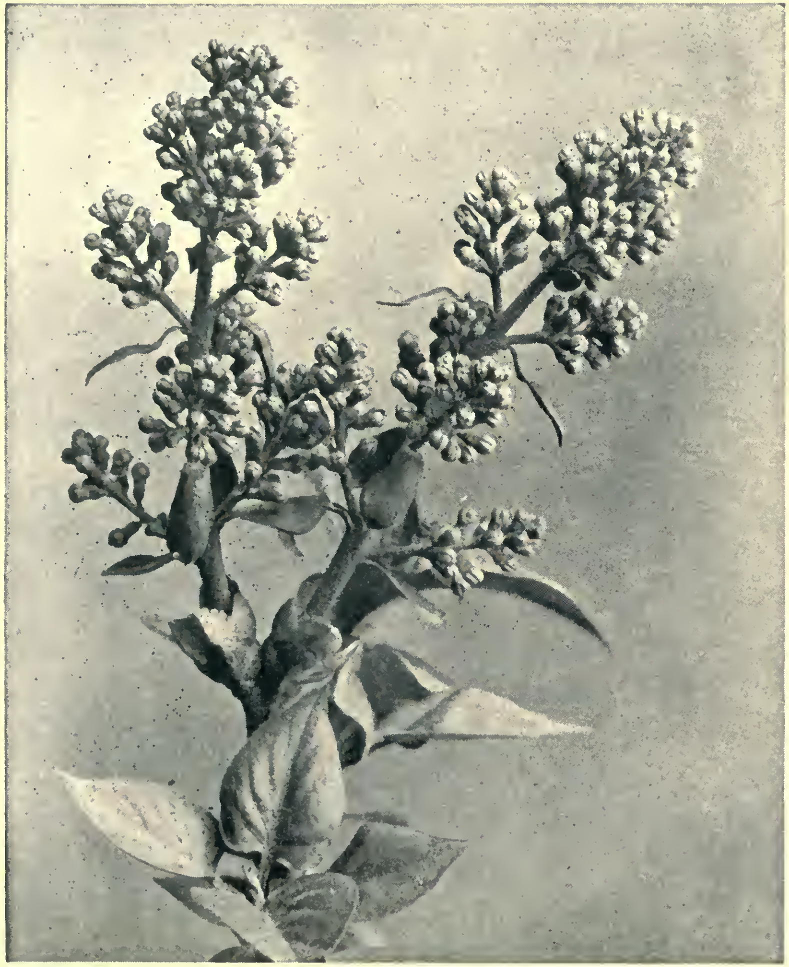


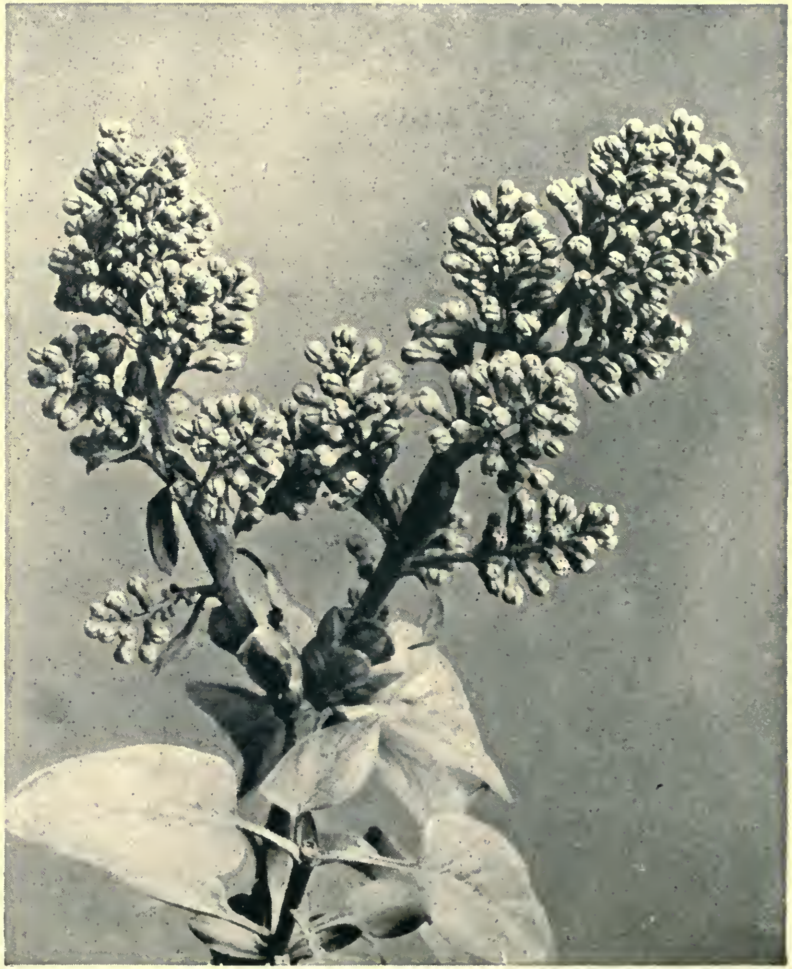
Seventh Week



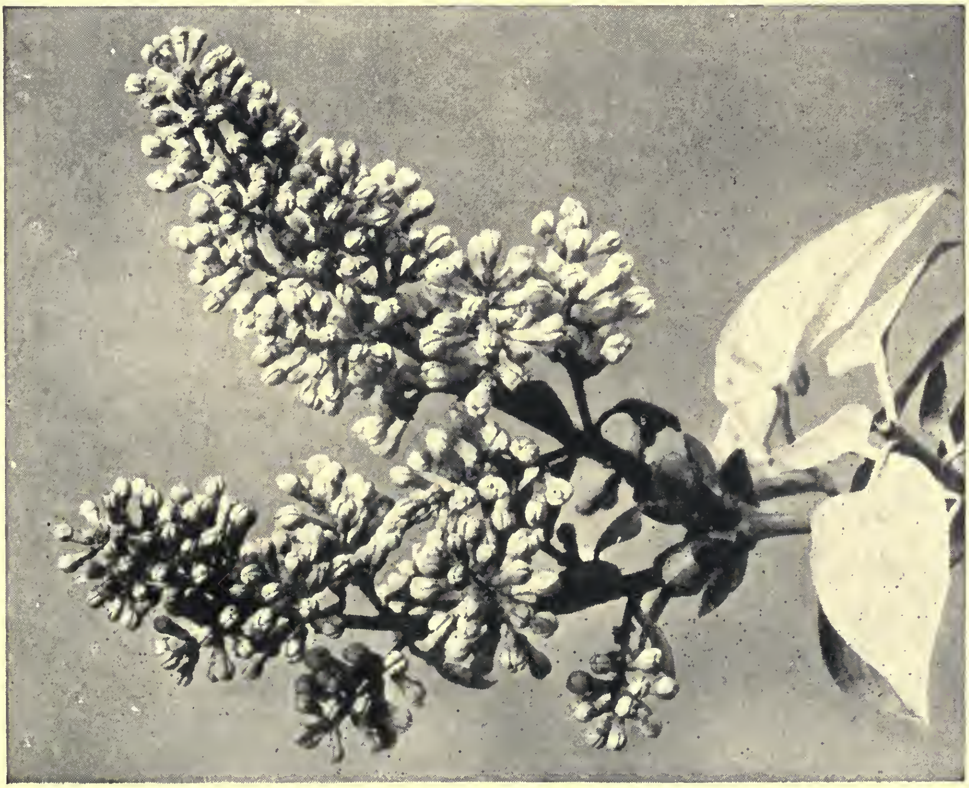
Eighth Week



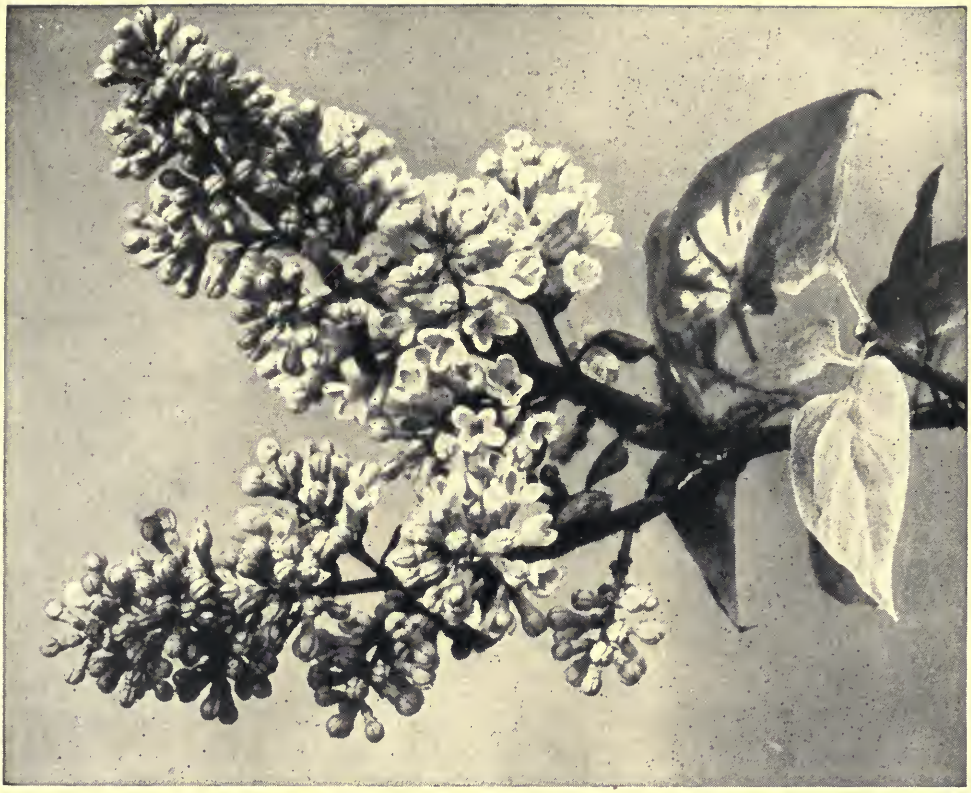
Ninth Week



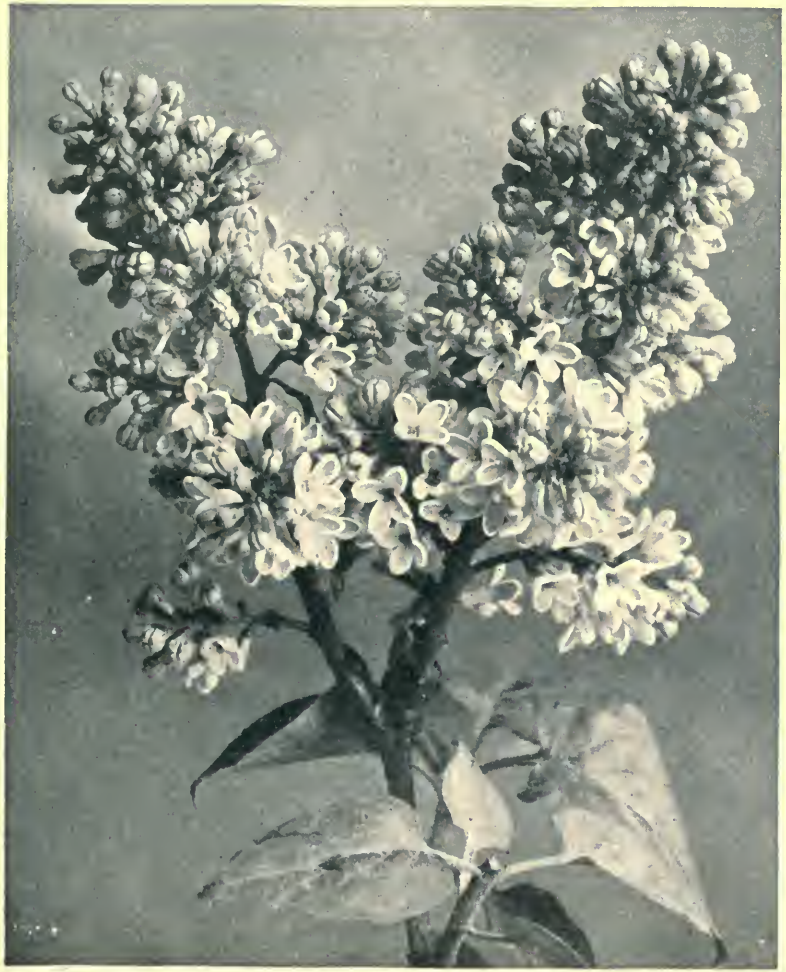
Tenth Week



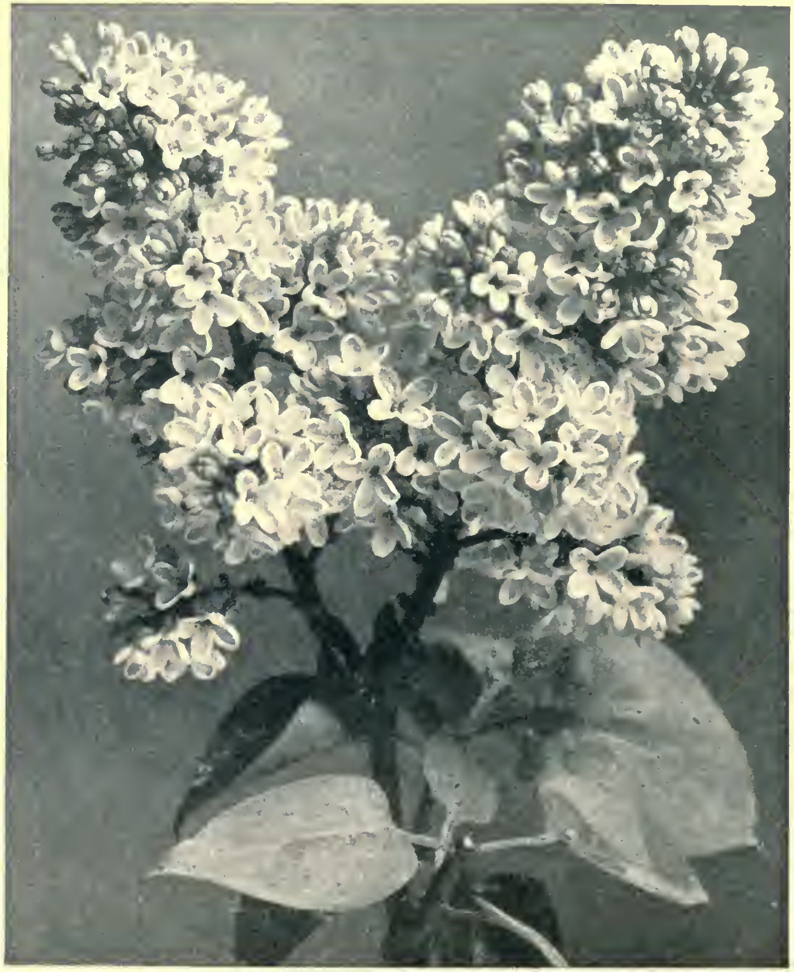
Eleventh Week



Twelfth Week



Thirteenth Week

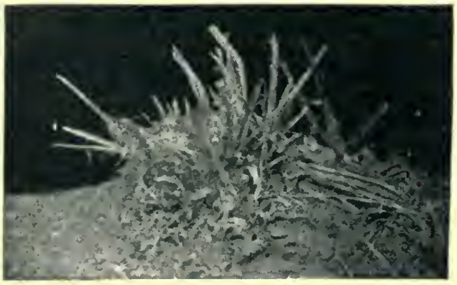


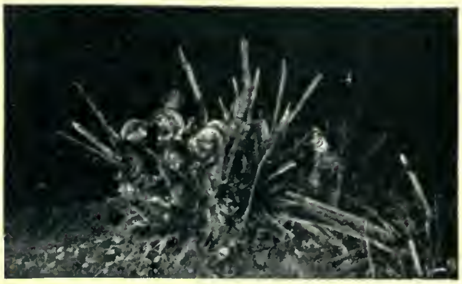
Fourteenth Week

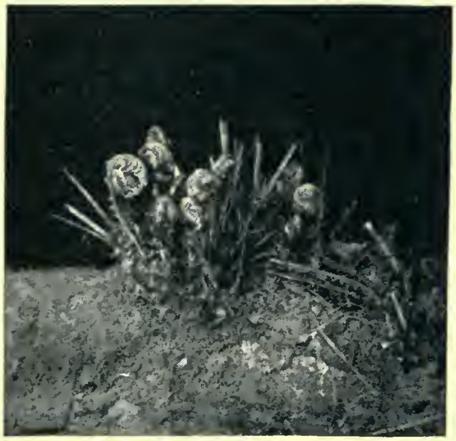
THE LILAC IN THE FULLNESS OF ITS GLORY

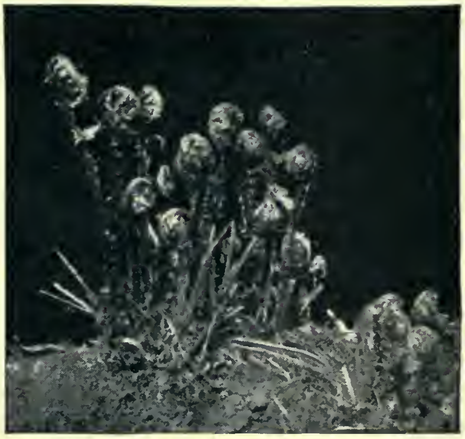
Fifteenth Week

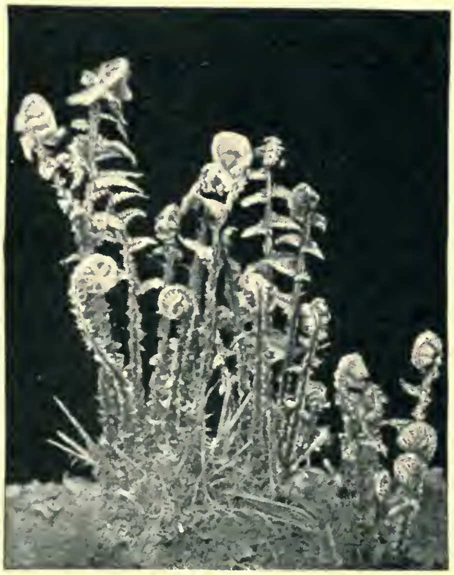
SIX DAYS IN THE LIFE OF A FERN

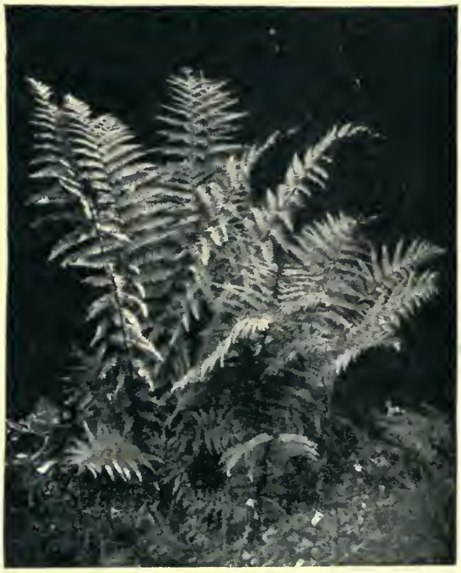

THE DAY OF PLANTING


THE THIRD DAY


THE FOURTH DAY

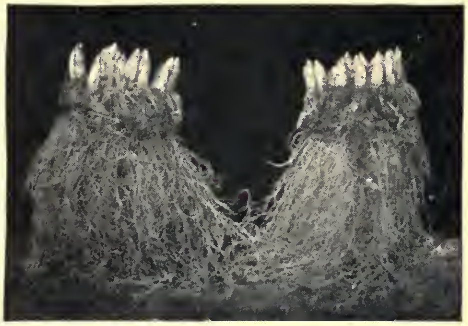

THE EIGHTH DAY


THE TWELFTH DAY

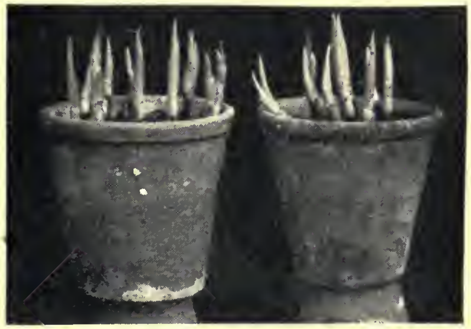

THE TWENTIETH DAY

One of the most interesting things that we can do in the country is to watch the growth of the plants. Some grow very slowly, some spring up so rapidly that we can almost see them growing. These six photographs of the same fern, taken on six different days, show us how quickly this beautiful plant unfolds and becomes a thing of beauty. There is something especially attractive about the fern, which keeps itself curled up like a little shy child covering its face with its hands before strangers. When the fern is about a fortnight old, however, it is like a child that grows older, and it then throws out its leaves and opens them wide to catch the light of the sun Ferns were, in a past age, the most important vegetation on the earth, but they are now a form of life that is passing away.

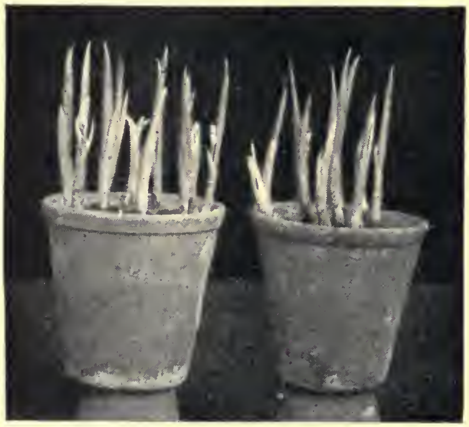
SIX DAYS IN THE LIFE OF A LILY



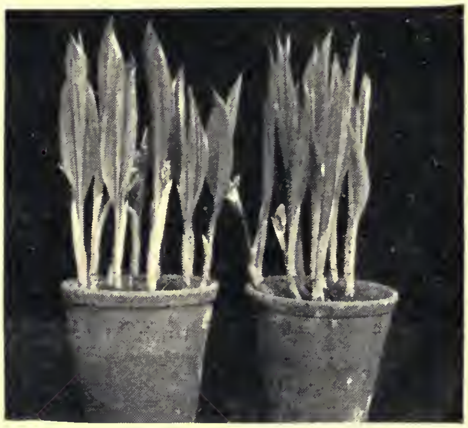
THE ROOTSTOCKS OF THE PLANTS



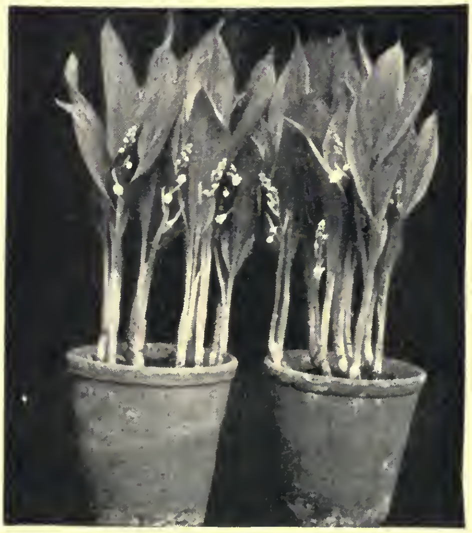
THE PLANTS JUST AFTER POTTING



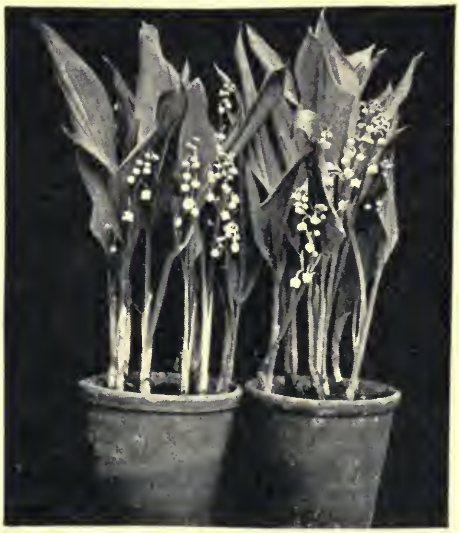
THE SEVENTH DAY AFTER POTTING



THE TENTH DAY AFTER POTTING



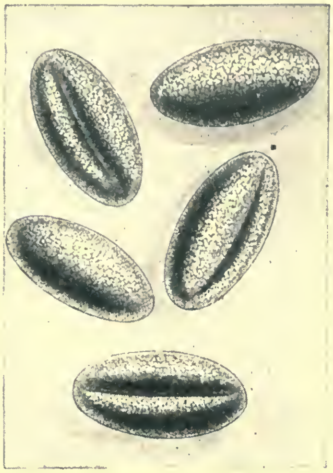
THE FOURTEENTH DAY

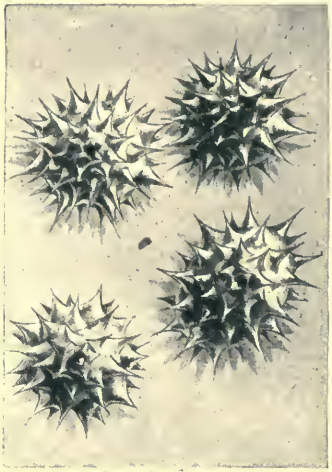


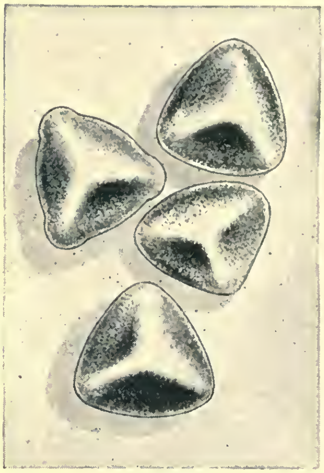
THE SEVENTEENTH DAY

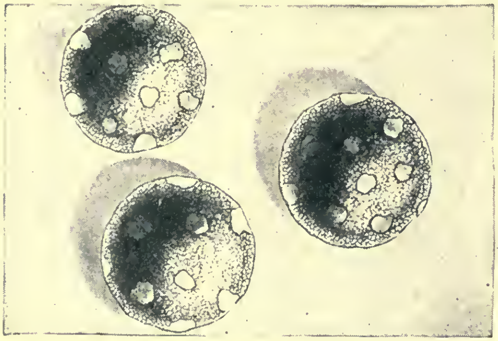
These photographs show the same lilies-of-the-valley taken on six different days. In little more than a fortnight the unattractive rootstocks developed into these delicate blossoms. The leaves spring direct from the creeping rootstock, their bases sheathed in one another, and within a few days they unfold and the flower-stalk rises with its tiny buds. A few days more, and these buds open as if by magic, and the dainty little nodding bells, that throw out a perfume almost overpowering, appear. Nature's magic wand has wrought the wonder. Perhaps the greatest marvel of all is that she does not even need our help, for in the woods, as well as in the garden, she produces these beautiful and fragrant flowers to delight our senses.

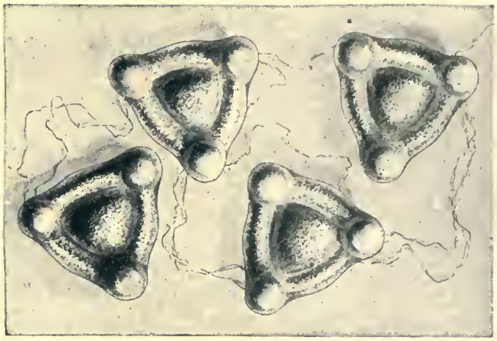
THE WONDERFUL POLLEN WITH POWER TO BUILD UP LIFE

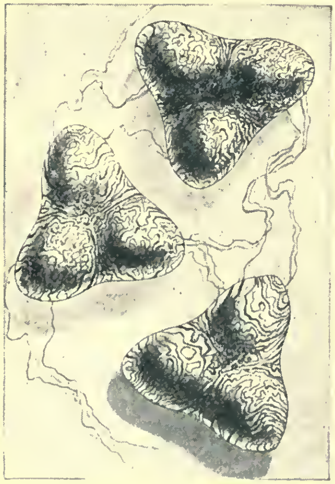

TIGER LILY

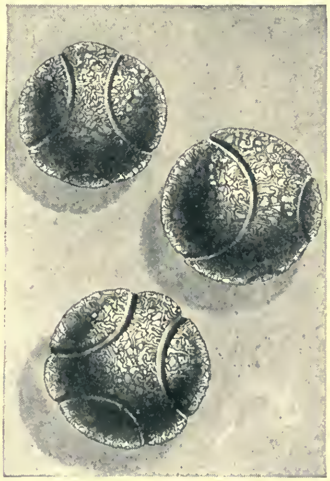

MARGUERITE

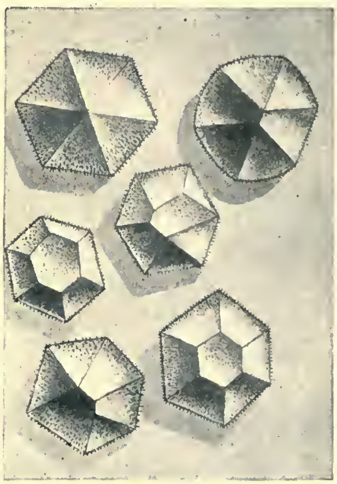

NASTURTIUM


PHLOX


ROSE-BAY OR FRENCH WILLOW


RHODODENDRON


BLUE PASSION FLOWER


DANDELION

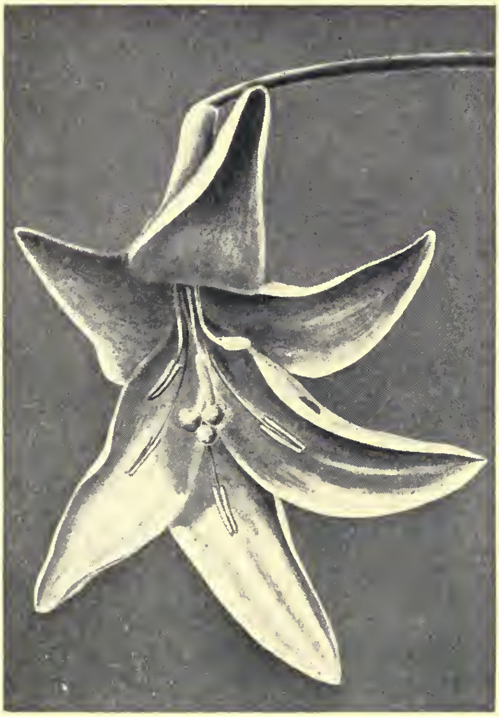
How immeasurable and unthinkable are the powers of Nature! No two flower-seeds are quite the same; neither are their pollen-grains. Nature has patterns enough and to spare, and she makes nothing, we must believe, without care and purpose. These few pollen-grains have been photographed under the microscope, and we see how beautifully they are made, though we cannot tell why this should be this and why that should be that. It is part of the great mystery that Life will one day reveal to its children.

A LIFE COMING INTO THE WORLD

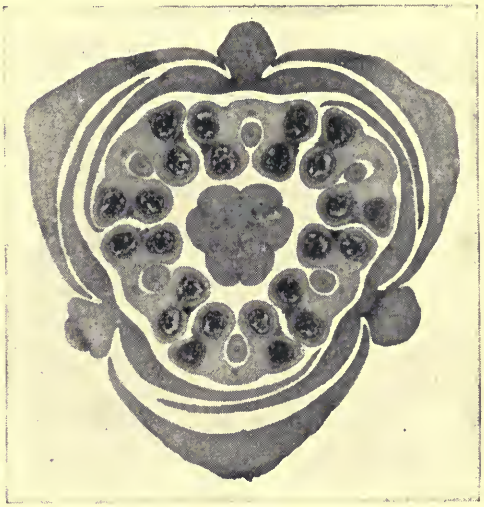
WHAT WE CAN SEE OF THE MIRACLE OF SPRING IN EVERY GARDEN AND EVERY COUNTRY LANE

HOW A FLOWER PREPARES THE WAY FOR ITS CHILDREN

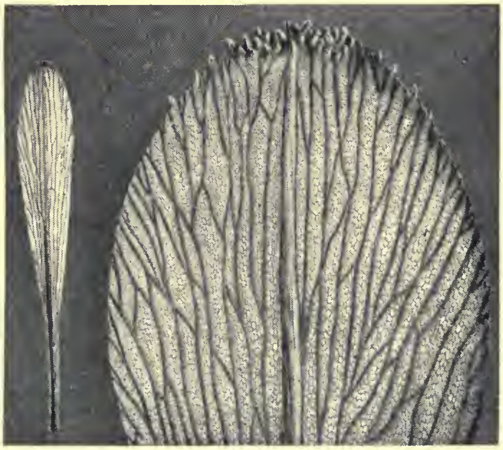
In every country lane in springtime, in every garden where the humblest flower is grown, a marvel happens which no man in the world can understand. "If I could know you, all in all, little flower," said Lord Tennyson, "I should know what God and man is." It is true. But we do not know the secret of this little thing. The story of a common flower is past the understanding of the mind that can weigh the earth, and measure the sun, and send the human voice across the sea. Let us go out in the garden and pull a flower, and look at it.



It is a Bermuda lily. On the outside are three coloured leaves—the sepals; inside these are three other leaves something like them—the petals. Sheltered within these protecting leaves are six slender rods—the stamens; they are something like pins with long double heads—the anthers. In the middle of these six rods are three rather sticky little balls—the stigmas. They rise from a sort of stick, the style, which runs down into a hidden case, the ovary, the very home of life. We shall see the wonderful things that happen in this hidden box, the silent factory in which Life works out its wonders. It is inside the swelling at the end of the stalk.

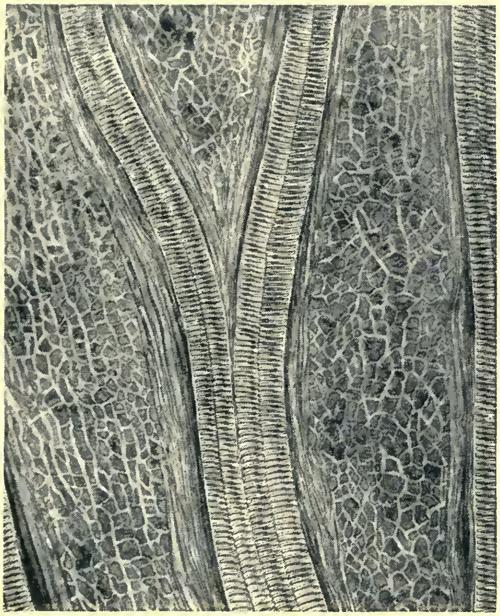


The inside of the flower-bud is like this; this is a slice across it. Going into it from the outside we pass three sepals, three petals, and six anthers, and then come to the central style, at the top of which are the stigmas, and at the bottom of which is the ovary, in which the flower is born.

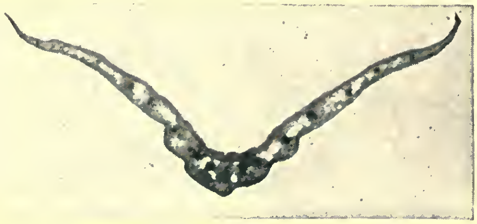


Here is one of the petals; on the right is the petal as we see it under the microscope, showing the veins that point the way for the bee when it comes to find the honey deep down in the flower.

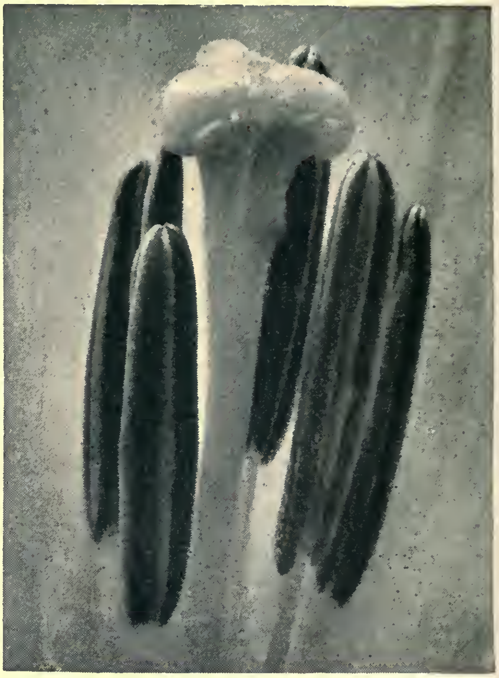
Let us look still closer at these petal-tips; their framework is beautifully built.



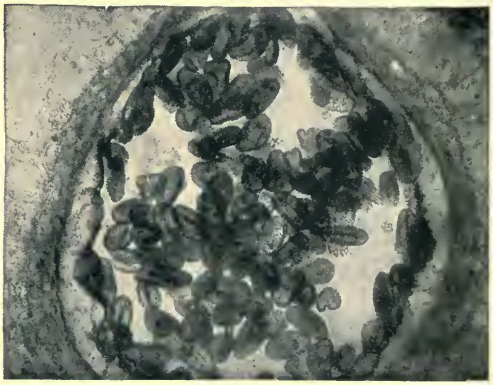
Adding to the power of our microscope again, so that we can see still farther into the petal, we find that these veins are wonderful things. Here, in the middle, is a forking vein made of four marvellous tubes built up like a spiral staircase. They carry food to the petals up from the root.



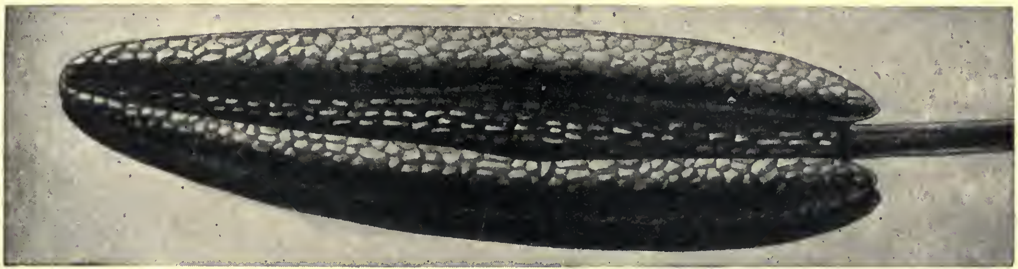
If we cut this slender petal in two and put the edge of it under a microscope, this is what we see in this thin edge like paper. The black patches are the veins.



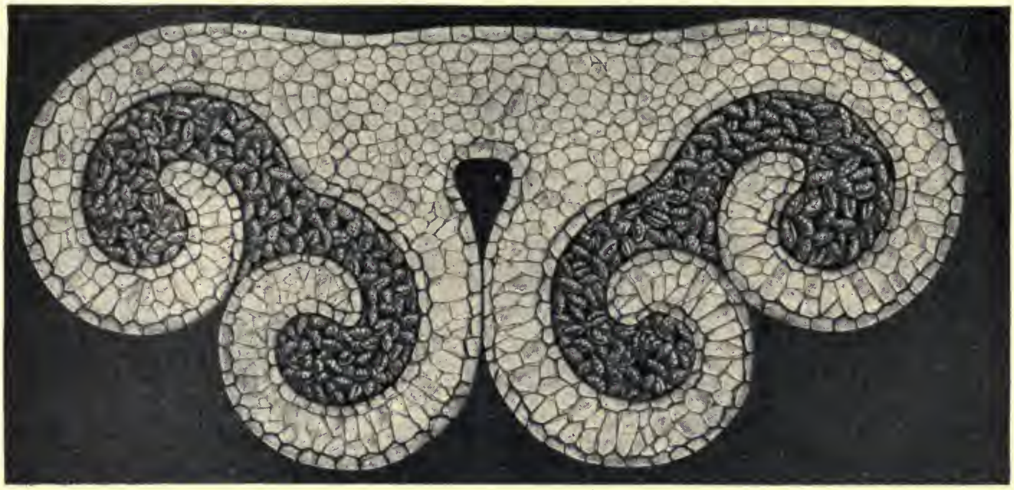
Now look closely at the six anthers, six little factories we may call them, clustered round the style that swells above them till the three-fold stigma bursts out at the top. Take your watch out of your pocket and think. Look at the works inside, and then say to yourself, "The works inside these anthers are more wonderful still."



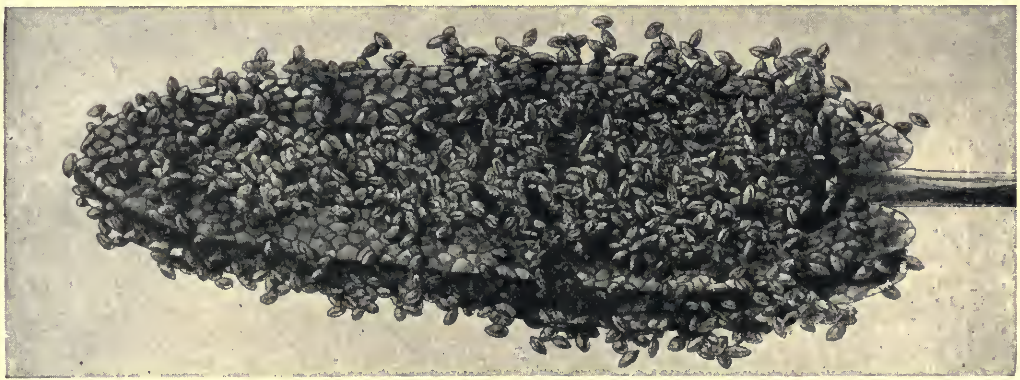
Inside these anthers are made the little grains of pollen we see lying in the anther here—the yellow powder that sticks to your finger if you touch it. We may think it is nothing, but is there anything in the world more wonderful? A speck of dust, a great man says, has power enough within it to break a continent in two, and this speck of pollen has the power to feed, to work, and to build up Life itself.



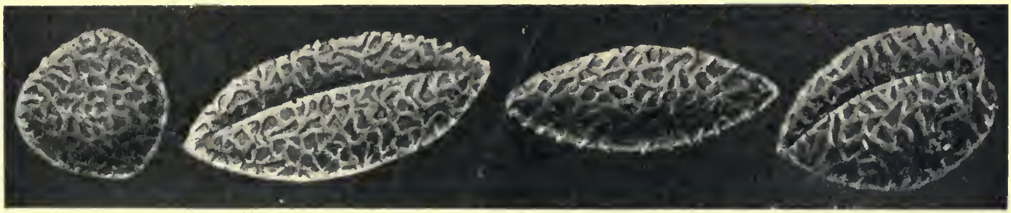
Let us look at the anthers under a microscope, while the walls of this workshop stand secure. For they are about to fall, pushed outwards by the growing strength within them.



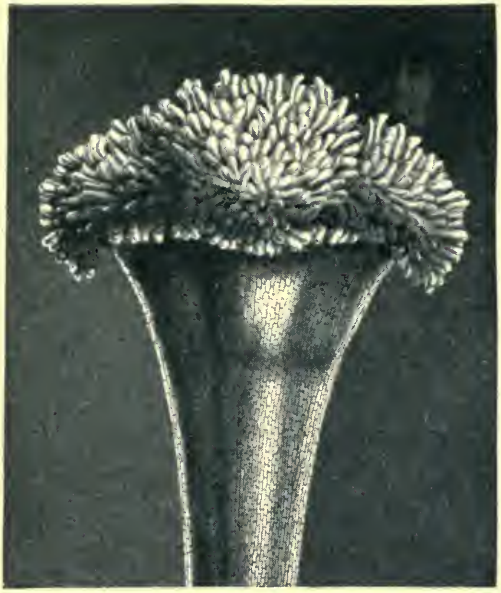
Sheltered from all harm are the wonderful grains, seen clearly in this cut across the anther, growing in power and building up the force that is soon to make itself known to us.



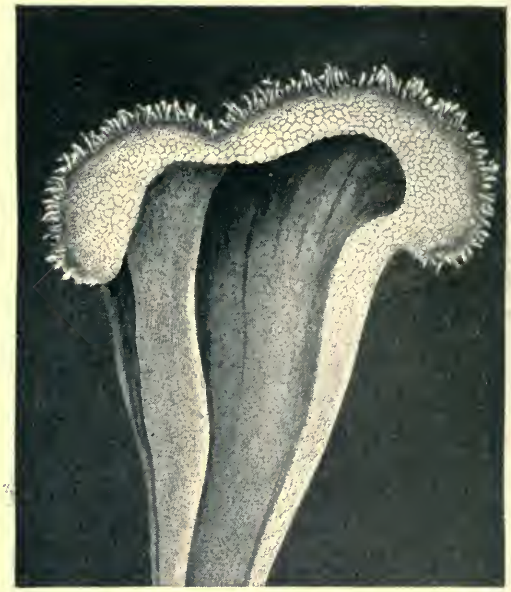
Now the grains have burst their bonds, and the anther is yellow with pollen. Like a magician's wand it is, for a touch of this pollen brings a new flower into the world.



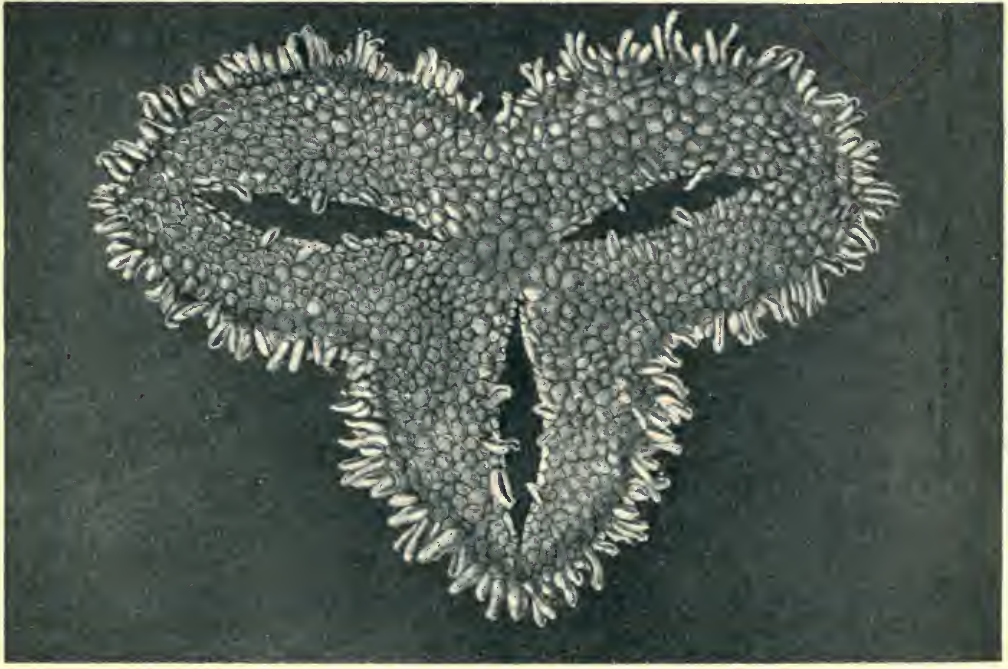
We see the pollen-grains closely here, greatly magnified. Marvellously are they made, with rough coats by which they will cling to the hairy body of the bee when it comes.



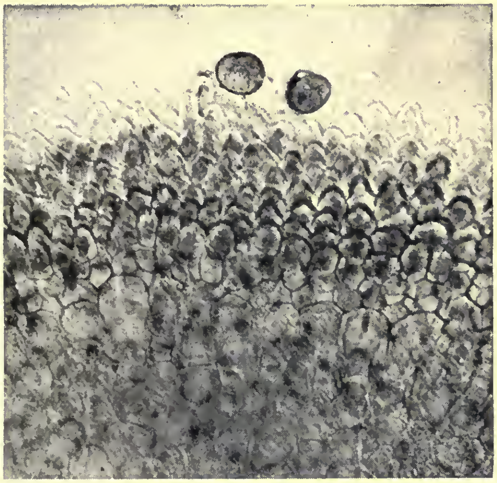
Let us look now at the stigma, and look closely at the top of it. We see how easily a grain of pollen may lodge in this rough place held by these rough, sticky points which the microscope so clearly shows. Here the grain lies and waits until the moment comes for the great work it is to do.



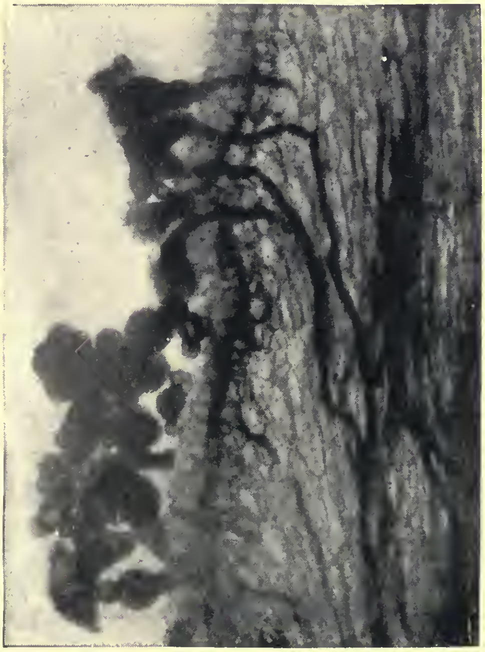
And now we cut right through the stigma downwards until it looks like this. We see its delicate structure, how beautifully it is made, but, more important still, we see a hollow passage down the style. It is an astonishing thing that travels down this passage to the home of life below.



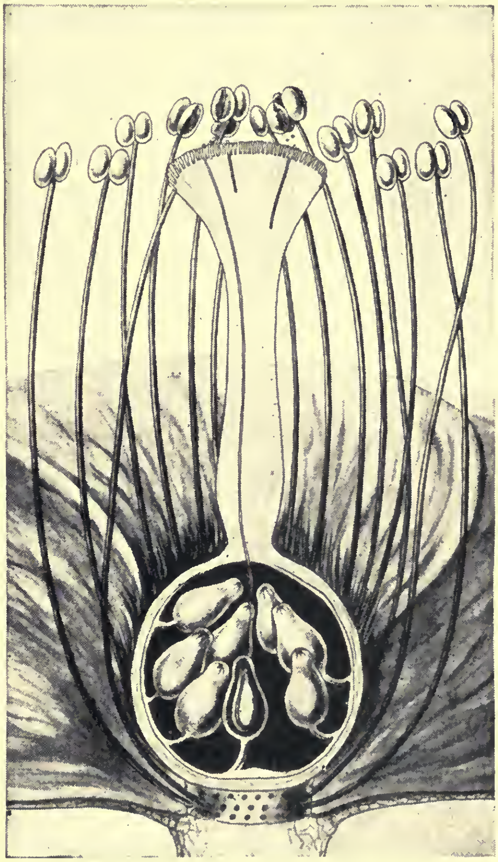
There are three of these narrow ways through which there comes to the heart of the flower the messenger of Life. Through each of the three heads of the stigma this hollow passage runs, until the three join in the style and run as one to the ovary below. Here we have cut a slice across the stigma showing the three ways leading to the ovary.



Now comes the bee this way, fresh from another flower, laden with its sweet and golden stores, and covered thick with pollen-dust. It must brush past the stigma on its way to the nectar, and it leaves on the stigma tiny grains of pollen from another flower. Here we see them as they lie ready for the work before them.



And now is the wonder of wonders. The gold dust of life is the pollen, and there is something in these little grains that makes all the world laugh when a man says there is no God. For these little specks are engines, and have the power to "do things." They make their way down through the stigma till they reach the hollow space. They swell up and begin to grow, and each one of these tiny grains sends out a wonderful tube. It shoots out and passes down the narrow space until it has reached the ovary, the place where the seed of life is hidden. Let us follow it there, down the passage, to the scene of the great event now almost in the making.

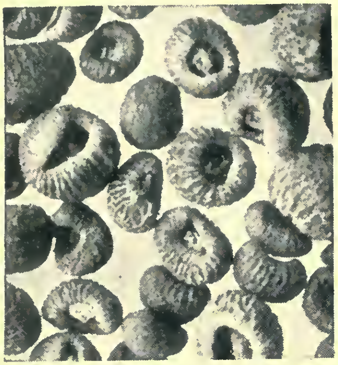


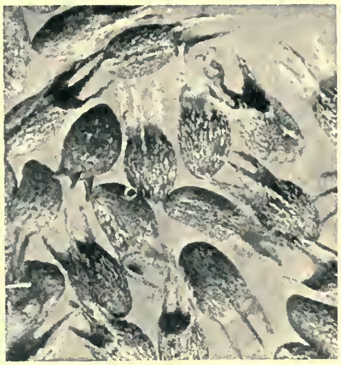
This is the place where a flower is born. In this sheltered chamber, the very holy of holies of the garden of God, are colonies of little green things called ovules.

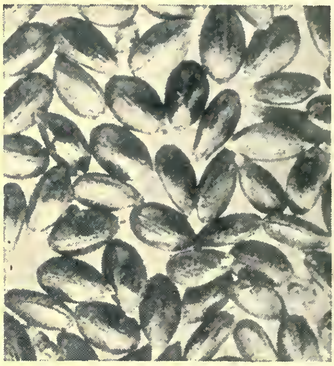
They lie here waiting for the messenger who comes from the outside world. Soon the pollen-tube arrives, making its way through the wall of the ovary and pushing on until it touches a little green ovule. If the tube does not touch it the ovule must die, but at the touch of the pollen-tube it grows into life, becomes a seed, and will become a flower.

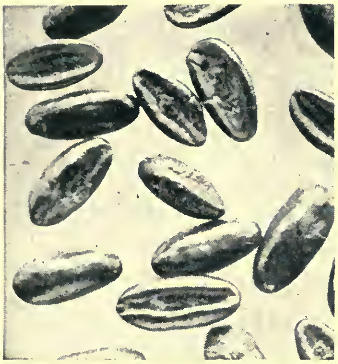
A new life has been born into the world; the wand of Nature's wizard has penetrated her hidden ways and wrought a miracle there, and we have passed by, perhaps, unheeding and unthinking.

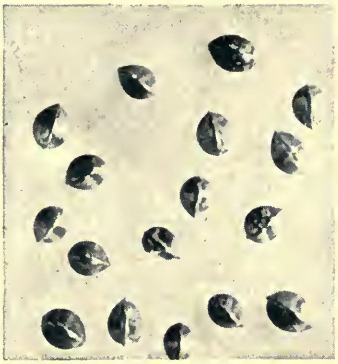
THE LITTLE TREASURIES IN WHICH NATURE HAS

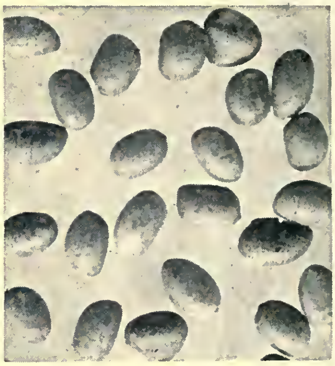

IVY-LEAVED SPEEDWELL

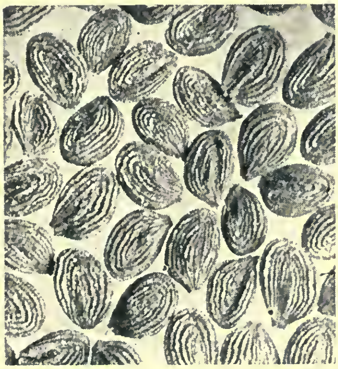

FIELD MADDER


SELF-HEAL


NARROW-LEAVED PLANTAIN


SHEEP'S SORREL


DOVE'S-FOOT GERANIUM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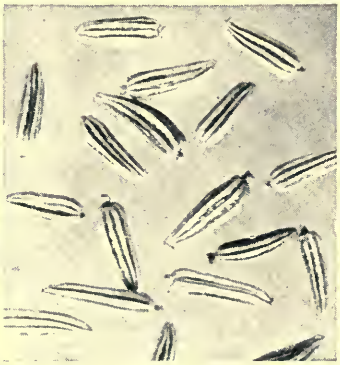
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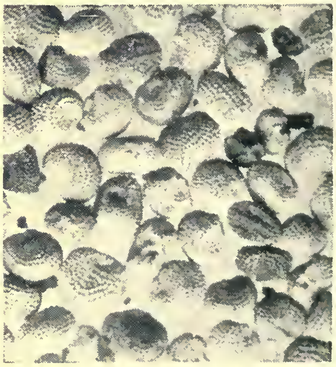
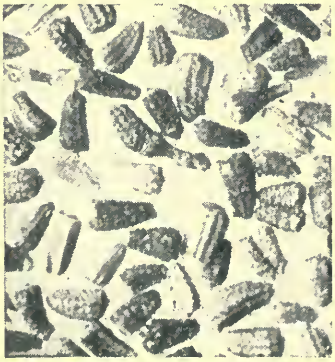
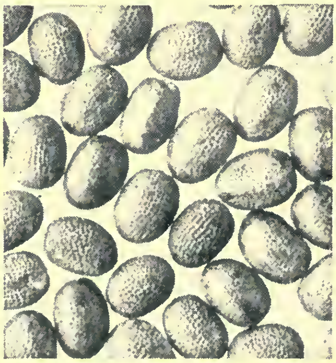
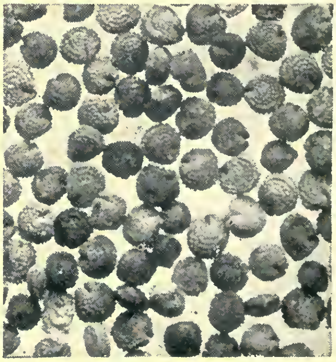

WHITE CAMPION

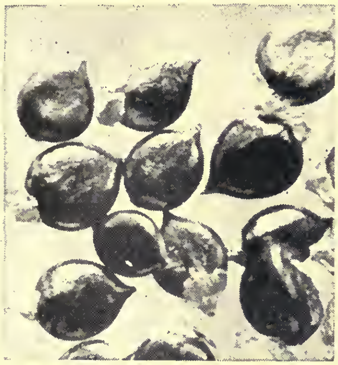

STINKING MAYWEED

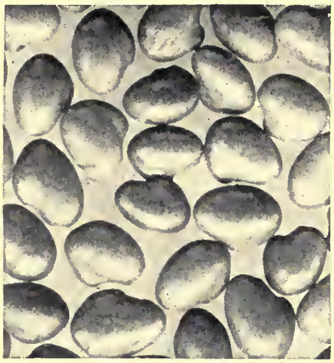

JAGGED-LEAVED CRANE'S-BILL

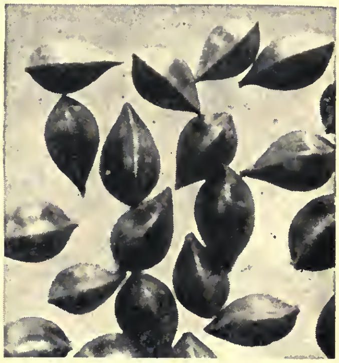

COMMON CHICKWEED

THE MICROSCOPE IN A COUNTRY LANE—WHAT THE SEEDS OF

LOCKED UP THE SECRET OF THE COMING SUMMER


SPOTTED PERSICARIA


RED CLOVER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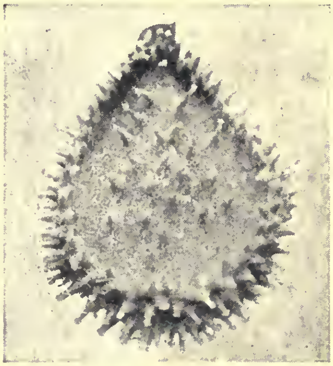
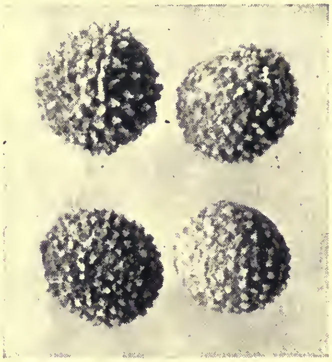
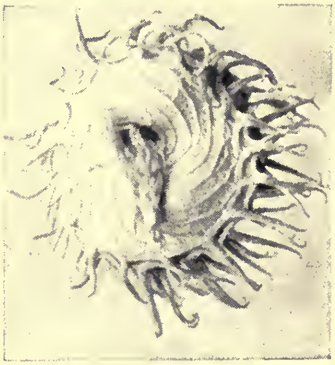
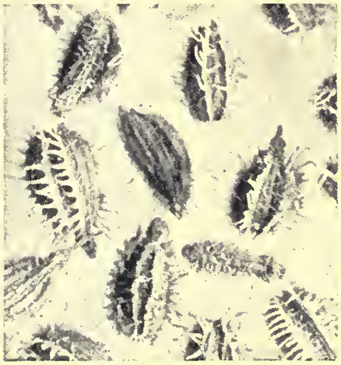
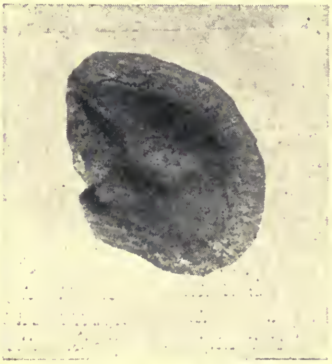
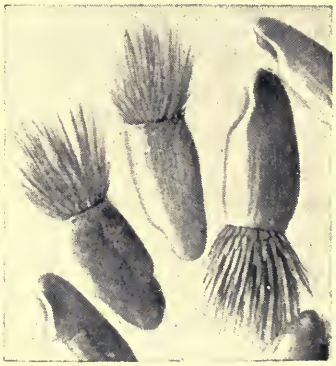

HOUND'S-TONGUE

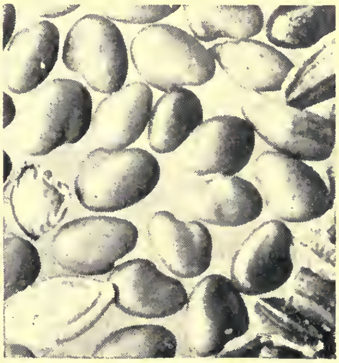

CLEAVERS OR GOOSE GRASS

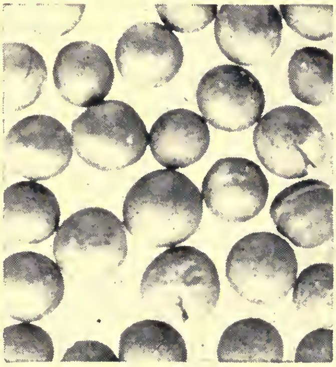

TOOTHED MEDICK

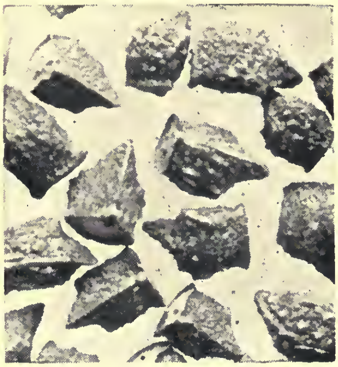

WILD CARROT


YELLOW RATTLE

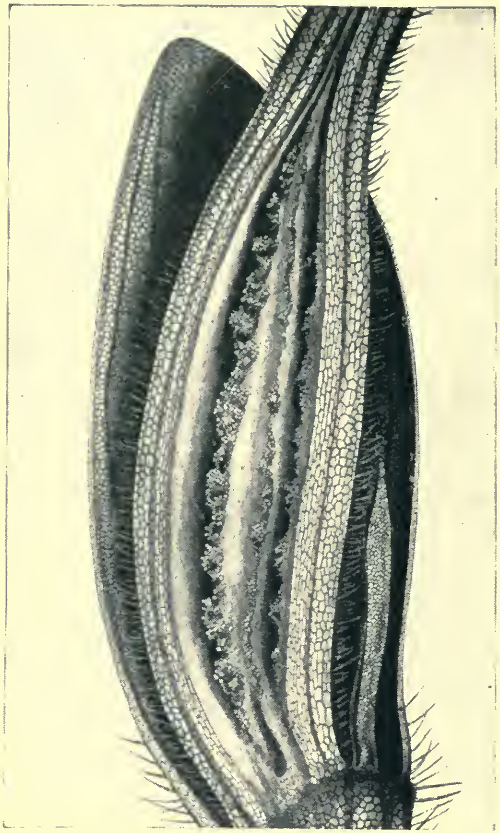

CORNFLOWER


CLOVER

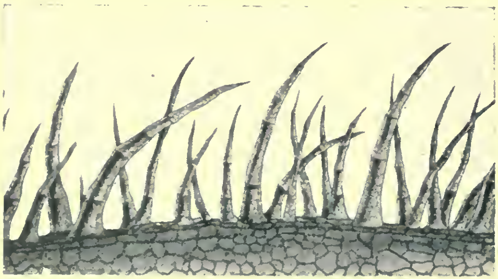

CHARLOCK


VIPER'S BUGLOSS

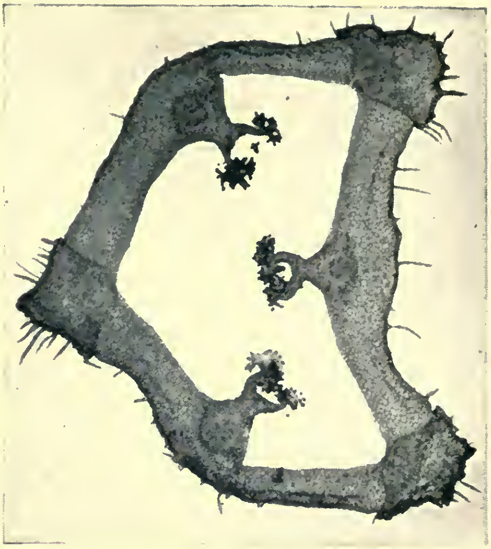
FAMILIAR WILD FLOWERS LOOK LIKE WHEN LARGELY MAGNIFIED



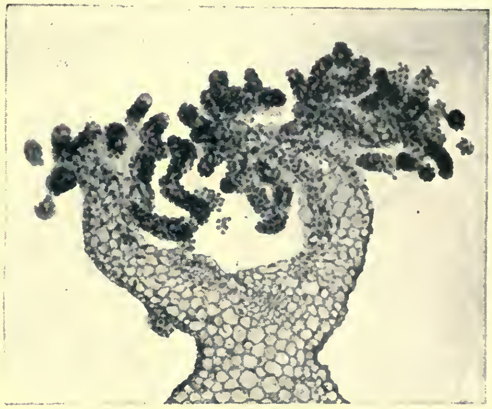
Now we will peep into the ovary itself, cutting through it downwards. It happens that we have taken the lady's slipper, a distant cousin of the lily, for this picture. The little white specks on the ridge in the heart of it are the ovules. Marvellously sheltered is this inner chamber where a flower is born, yet the gold dust the bee has brought from far away throws out its tubes and pushes down with its quickening touch until, from this hidden place, there comes out into the world the beginning of another flower.



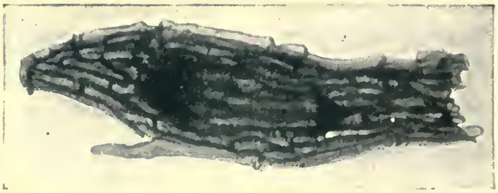
Let us notice the little hairs that protect the walls of the ovary: here we see a few of them largely magnified, and see how powerful they are to serve their great purpose.



We have cut through the ovary downwards; now we see it cut across. The little ovules are clustered on the three little ridges.



Now we turn the microscope on to one of the three ridges and see the ovules nearer and nearer. Each little group of specks makes up an ovule, and, at the touch of the pollen-tube, springs into life.



It grows into a seed like this. Even here, in this largely magnified photograph of a seed, the eye seems almost nothing, yet this tiny thing, brought into life by the touch of a pollen-grain, has in it the power to reproduce the flower in which it grew. It is the cradle of the beauty of the earth.

SOME DELICIOUS TROPICAL FRUITS AND HOW THEY ARE EATEN

MANY tropical fruits are, of course, perfectly well known to us. We often see oranges, bananas and pineapples and do not need to be told how to use them. But if we should go to some country near the equator we should find some of the fruits we know served differently. Cocoanuts are used frequently when only half-ripe, or even very green. One often sees, in the tropics, carts piled high with strange whitish spheres, which negroes armed with huge knives are slashing open and throwing to customers, who, catching them, invert the openings over their capacious mouths, and allow a transparent fluid to stream down their throats; for they are utilising the most hygienic drink that exists — the liquid in the water-cocoanut. This water fills the very young, green cocoanut and is obtained by cutting away the soft husk at that stage. In the ripening nut, when left on the tree, the water deposits, as it were, a jelly-like lining, quite flavourless, which is also cool and wholesome. It is only when the fruit is mature that the flesh becomes the hard, ivory-like, full-flavoured substance known in the North; but before it is so hardened, in the South, it is often grated and squeezed, yielding a most delicious "cream" for dessert.

Tropical folk spend a good deal of time teaching travellers how to eat fruits too fragile to be taken North. Many of them, as an old English missionary regrets, "are most fair and beautiful to behold, most sweet and luscious to taste but little inward virtue or nourishment in them." His Queen, Elizabeth, went further and declared that "surely where these fruits grew the women were light, and all the people hollow and false-hearted."

Among them are several odd-looking fruits of the Anona family. Let us imagine, as a famous writer suggests, "a custard enclosed in a rough skin bag, most lusciously sweet," and we have the custard apple or bullock's heart, as it is called in the East Indies. This is not so much liked, however, as the cherimoya, or the soursop, or the sweetsop. The latter resembles somewhat a soft-scaled cone with creamy-white skin showing between the green knobs. It is rather bigger than an apple, and when ripe is so soft that one plucks it apart with the fingers, disclosing a white pulp of sugary but insipid flavour in which slender black seeds are imbedded. The soursop is more acidulous. It is a huge, shapeless, flexible, dark-green bag armed with feeble prickles, and is also pulled apart (in the kitchen), and the dark brown seeds painstakingly forced from woolly capsules filled with pulp which, served with cream and sugar, tastes a little like a musky lemon sherbet.

The sweet-fruited papaw of our Southern states belongs to this family, but the papaw of the tropics is quite different. It is a weird tree, or rather, a herbaceous plant which shoots up above other herbage, and carries an umbrella-shaped crown of deeply cut foliage beneath which hang great clusters of melon-like fruits. In texture and taste each resembles a melon but the interior is hollow and around its walls cling small black seeds that remind one unpleasantly of well-developed frog-spawn. The papaw is greatly valued for its medicinal effects, greatly aiding digestion.

One may overhear a Jamaican negress accuse another of being "just as deceitful as a starapple" or reproach her with "hanging on like a starapple." The former is a reference to the turncoat character of the leaves, which have tan-coloured satiny under-surfaces. The globular fruit is green or splashed with purple, and the colour stains the flesh, as one discovers, when the fruit is cut rather above the middle. This cut discloses the star-shaped arrangement of seeds lying in a translucent firm pulp which looks and tastes like raw gelatine. The flesh is extracted with a spoon and from every pore during the process exudes a milky juice that clings to lip and spoon with rubber-like tenacity.

The sap, "chicle," of the sapodilla tree or naseberry, a fruit that is often seen on tropical tables, is largely used for chewing-gum. This fruit, which is closely related to the starapple, is exactly like a small unwashed potato in appearance. It is broken in two, when eaten, disclosing a

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soft pulp dipped out with a spoon, and is considered to be one of the best of the tropical fruits. "An overripe sapodilla," declares a Frenchman, "is melting, and has the sweet perfumes of honey, jasmin, and lily of the valley." A more prosaic man describes the flavour as resembling that of the baked pear. The tall tree loaded with clusters of brown fruit among shining foliage is common in the grounds belonging to the houses in tropical cities.

When mangoes are ripe, Wèst Indian bakers expect to sell less bread, for the negroes live chiefly on the fibrous aromatic fruits. To eat a mango among civilised people requires a pretty skill in carving. A mass of fibres enwraps the huge flat seed and it is almost impossible to bite into a mango without entangling the teeth and shooting the juice in every direction, so that one soon needs a bath, as the English bluntly say. One must instead grasp the oval mango firmly at both ends and make an annular cut around each end, thus forming an island, so to speak, under the thumb and finger. Then a belt of skin is pared away between the islands, exposing orange-tinted flesh. By cutting carefully, not too deep, and downwards from the stem end (with the fibres), slices of tough flesh, somewhat gummy, somewhat turpentiny in flavour, rather tantalising, are obtained. Everywhere one finds the flat, oval, dried seedcases, brown and stringy, discarded by negroes who gnaw the fruit regardless of ceremony. In this way mangoes, originally brought from the Far East, become common in the West. They are round-topped trees much resembling chestnuts, whose dense foliage casts a grateful shade.

The dome-shaped tamarind, another wanderer through the tropics, bears lacy foliage and masses of beanlike fruits whose buff shells can be easily crushed by the fingers, revealing a dark brown pulp which affords a fine sweetmeat and cooling beverage.

"The world may laugh at famine when forest trees yield bread," sings Tupper. Nevertheless the West Indian peasant fears a famine if his breadfruit and akee trees have been stripped by hurricanes, for he depends greatly upon their fruit for food. They are both served cooked as vegetables, as is also the jack fruit, more common in Asia. The breadfruit, brought from the South Sea Isles, is frequently seen in crowded towns as well as in the country. The tree is rather ungainly, with enormous, deeply-cut leaves, among rosettes of which cluster the elliptical green fruits at the end of burdened branches. When boiled the breadfruit gives one the impression that it is made of waxy wool with no flavour in particular.

Akee and salt fish may be called the national dish of Jamaica although one ingredient hails from Canada, and the other from Africa. The akee tree is very handsome and decorative and is grown frequently on town lots. Its scarlet fruits swing gaily under glossy dark foliage like little Chinese lanterns. Three-lobed, two or three inches long, in ripening they split into thick fleshy valves, showing within a trio of brilliantly black and glossy seeds perched on crumpled masses of creamy-hued tissue, that, when boiled, look and taste exactly like scrambled egg-yolks. Unluckily the akee is an extremely dangerous fruit, for if it is gathered before it has opened completely on the tree and of its own accord, it is very poisonous.

GRAPE-FRUIT

THE UNOPENED NUTMEGS AMONG THE BRANCHES LOOK LIKE LARGE HICKORY-NUTS

THE PALE BLUE AND YELLOW FRUIT OF THE MANGOES ARE MOST IMPORTANT IN THE TROPICAL BELT

TAMARINDS ARE USED FOR PRESERVES AND COOLING DRINKS THROUGHOUT THE TROPICS

THE JACK FRUIT RESEMBLES THE BREADFRUIT AND IS AN IMPORTANT FOOD IN THE PACIFIC ISLANDS

THE SWEET-SOP IS A CREAM-COLOURED AND GREEN SOUTH AMERICAN FRUIT

THE SWEET-SOP IS COMMON IN JAMAICAN YARDS AND ALONG WOODSIDES

THE BROWN FRUITS OF THE NASEBERRY, KNOWN ALSO AS THE SAPODILLAS, ARE MUCH LIKED IN THE WEST INDIES

THE STAR-APPLE IS A TROPICAL AMERICAN TREE WITH PARTI-COLOURED LEAVES, AND ROUND FRUITS OF THE SIZE OF AN APPLE

THE AKEE IS A HANDSOME, SCARLET FRUIT BROUGHT FROM AFRICAN FORESTS TO THE WEST INDIES

THE CUSTARD APPLE IS A TROPICAL AMERICAN TREE, WITH LUSCIOUS BROWN FRUIT

IN THE WEST INDIES ORANGE-TREES SPRING UP EVERYWHERE

THE SOUR INDIAN LIMES ARE USED INSTEAD OF LEMONS

SEEDS OF THE COCOA-TREE WERE FIRST USED BY THE AZTECS FOR FOOD AND COSMETICS

THE BREADFRUIT-TREE FROM THE SOUTH SEA ISLANDS YIELDS A VALUABLE FOOD FOR WEST INDIANS

FIGS ARE VERY NUTRITIOUS SOUTHERN FRUITS, EASILY TRANSPORTED TO COLDER COUNTRIES

SUGAR AND SPICE AND ALL THAT'S NICE

That's what little girls are made of! concludes Nurse, triumphantly. If she is correct, tropical maidens must be very tempting, for all these ingredients grow near the equator. Of course Northern people discovered that sweet juices ran beneath the outer bark of some trees in the spring and scraped and ate the inner bark-layers of certain pines, and cottonwoods, or collected the juice of box-elder and sugar-maple. They even contrived to make a sort of molasses out of cactus fruits and have utilised the sugar-beet.

However, the sugar obtained from sorghum or from the sugar-cane, both nearly related to maize, is what we know the best. A plantation of sugar-cane resembles an untidy corn-field, full of suckers, but the tall stalks turn to a golden colour and the large nodes, or ridged rings, about them, are tinted with green and purple; the bloom is feathery and silvery, like that of Pampas-grass. There was much romance and considerable scandal about the huge, wealth-bringing sugar-estates of the West Indies, where the naturally indolent negro slaves were forced to take care of themselves and of the "Massa's" cane-fields too; and they worked hard at the mills where the cane was crushed between rollers and the juice boiled again and again until the sugar became crystallised. Rum was made from the molasses.

The addition of sugar to chocolate greatly disturbed gentlemen in England, one of whom declared that it turned what had been a medicine into a poison. Many people at the end of the seventeenth century felt compelled to take sides for or against chocolate because the drink, in spite of its high cost, became all the "rage."

Young cocoa, or properly, *cacao,* trees need shade, and they were often planted between rows of the cocoa-mother or coral-tree, with its crown of flame. Nowadays bananas are used. Ungainly, low and broad-topped, with large leaves, they are arranged in ranks as they were in Montezuma's time, when, as Cortez wrote to the King of Spain in 1520, "he ordered made a plantation of ten thousand *cacao* trees, which bear a fruit resembling an almond that is sold after being ground, and is held in such estimation that it is used as money throughout all the country and employed in purchases in the markets and everywhere else." Into these groves rushed the poor Aztecs, only to be hunted out by the ravaging Spanish. The little brown nuts were sent as tribute to the Lords of Mexico and were laid as offerings before the Aztec gods. They were, of course, taken early to Spain, and it was the habit of conquering but ignorant British, one historian laments, "when they had taken a good prize, a ship laden with *cacao* to hurl it overboard," wishing it were gold bars. The little nuts, that resemble pecans, lie snugly in the cool white pulp of gay corrugated fruits that hang from gray-barked trunk and branch like miniature foot-balls, among scattered tufts of starry, pink blossoms. They are brought to market by the peasants in handfuls and gradually collected for export. The kernels look and taste like chocolate but are rather bitter and rich with an oil that is extracted as the butter of *cacao* much used by druggists.

Chocolate was served to the Aztecs cold and stirred to a froth with a twirling stick, and an old missionary guessed that the name chocolate came from the sound "choco," "choco" of the whirling liquid, combined with the Mexican word meaning water. It was flavoured with the fragrant pencil-shaped pods of vanilla, an orchid which creeps up tree trunks in hot forests. Its pale green flowers must be artificially fertilised in order to obtain a full crop of the pods which are also artificially-, or sun-dried, until they become almost black.

Coffee, coming from the Tropics of the Old World, shared with chocolate the abuse of early English wiseacres who objected to its rapid spread and to the arising of the famous coffee-houses, favourite meeting places in London. It is one of the prettiest shrubs or little trees imaginable; its fragrant starry flowers gleam like snow on the shady hillsides where they thrive. And they are followed by gay oval berries, crowded in the axils of slender branches, changing from green to yellow, and from yellow to scarlet. Each berry conceals under thin pulp, two big seeds, like half-globes clapped face to face, and surrounded by a silvery, papery skin. Freed of pulp and parchment, and

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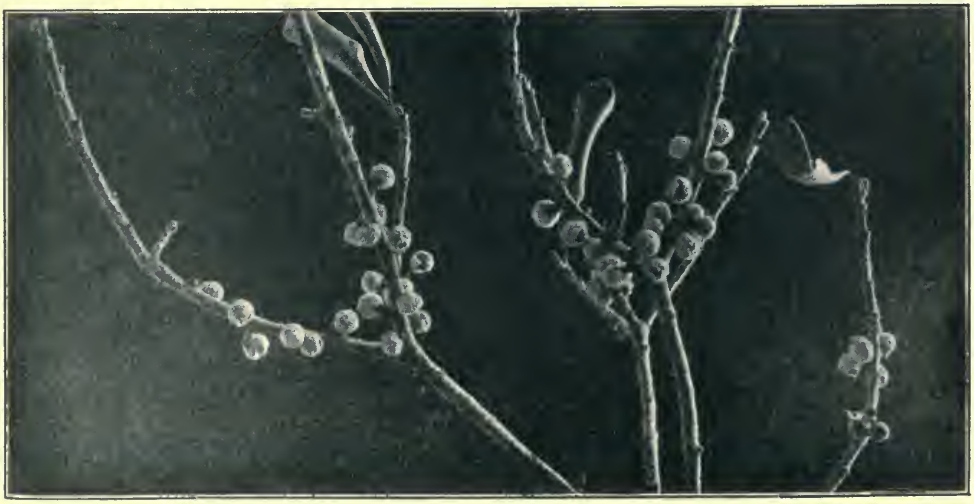
dried, the coffee beans are ready to be roasted.

The clove-tree, the cassia and cinnamon, both of which entered into the composition of the holy ointment to be made by Moses, and the nutmeg, are all Asiatics and are grown largely in the East Indies and somewhat in the West Indies. They all contain oils which may be intended to protect them from attacks of birds and animals, but their aroma and spicy flavour are so pleasing to human beings, that the defence fails. The unopened buds of the slender clove-tree, which is so called on account of the resemblance of the bud to a nail (in French *clou*), when dried, are what is sold. Cassia buds are also used as a spice, but the thin inner bark, stripped from young branches of both cassia and cinnamon, curled into tubes or "quills," forms the most valuable product of these trees; of the nutmeg it is the fruit which is utilised, an oval brown seed surrounded by a scarlet network formed by a fleshy growth, which itself is marketed as mace. Both are enclosed in a thick husk about as big as a mockernut, and hang from the leafy branches of a very pretty tree.

The cassia and cinnamon belong to a family noted for its all-pervading aromatic qualities, and which is named for its most famous member, "the green bay tree," whose rigid leaves were woven into hero's crowns, and also serve for the humble office of spicing viands. Most of them have the simple shining foliage whose high gloss is characteristic of many tropical trees and is the result of nature's effort to equalise the flow of water through the leaf by thickening the skin; it contains also the camphor-tree with its pungent gum; the avocado-pear; the familiar spice-bush; and the even more familiar sassafras, whose orange-hued spicy roots were used for many a homely medicine and beverage and, as a "filet," was thrown into "gumbo" soup. Sassafras was at one time thought so valuable, "of most rare virtues in physicke for the cure of many diseases," as Thomas Heriot put it, that it was largely exported.

Bay rum, which one might suppose was a preparation of the sweet-bay, really comes from other trees, and in Jamaica it is extracted from the foliage of a pimento. Another variety of pimento, a lovely little tree with heavy dark foliage and pale gray bark, yields allspice, which is merely its unripened tiny fruits. Branches are broken off in the long rows or "walks," thus rudely pruning the tree, and women and children strip off the berries and spread them to dry on the huge cement platforms that exist for the purpose, and for drying coffee, throughout Jamaica.

Jamaica, too, grows that hottest of all spices, ginger; its knobbed, contorted, small brown roots are frequently displayed in the markets by handfuls; the plant is not tall and is reed-like. Cardamon seeds that flavour Indian curries, grow in little triangular capsules near the base of a taller plant, closely related to this ginger.



THE CLOVE-TREE IS CULTIVATED LARGELY IN THE MOLUCCAS, FOR ITS FLOWER-BUDS

THE YOUNG FRUITS OF THE PIMENTO ARE CALLED ALLSPICE

THE NUTMEG-TREE GROWS WILD IN THE MOLUCCA ISLANDS AND WEST INDIES

THE CINNAMON-TREE FROM CEYLON HAS SPICY BARK AND GLOSSY GREEN FOLIAGE

THE SWEET SAP OF THE SUGAR MAPLE WAS FIRST USED BY INDIANS FOR SUGAR

THE SPICY LEAVES AND THE BARK OF THE SASSAFRAS ARE USED FOR DOMESTIC PURPOSES

THE SCARLET BERRIES OF THE COFFEE-TREE GLOW AMONG THE DARK GLOSSY LEAVES

THE PAWPAW IS A TREE, OR GIGANTIC PLANT, WHICH BEARS MEDICINAL FRUITS

THE COCOANUT PALM, CELEBRATED EVERYWHERE IN THE TROPICS, RISES TO A HEIGHT OF 60-90 FT.

SPRAYS OF BERRIED IVY, SACRED TO BACCHUS, WERE OFTEN USED IN ANTIQUE ORNAMENTS

EUROPEAN RUINS AND BUILDINGS ARE OFTEN MANTLED WITH CREEPING, EVERGREEN IVY

PLANTS IN HERALDRY AND IN HISTORY

Without a little knowledge of the folklore of plants, particularly of those which serve as emblems, one is hampered in reading, picture-viewing, or even in sight-seeing, for allusions to them constantly occur. In the days when men went more frequently to war than to school, and wore armour with closed headpieces, they needed some means for their identification, especially in battle or in tournaments. They therefore adopted devices or badges, afterwards often embodied in coats of arms, embroidered on costume, or graven on armour and arms. They frequently chose some simple object, often connected with their personal history, and legends have grown up where the truth is lacking regarding the devices. Thus, a sprig of broom denoted the Plantagenets, whose name was merely a form of *Planta genista,* the Latin name for the broom (the French call it *genet* to this day). It is said that a wicked ancestor of theirs was whipped for his sins with rods of broom, thereafter flourishing a spray of it in token of humility. Or, as another explanation runs, a Duke of Anjou, admiring the way in which the broom-plant throve in arid places, stuck a spray in his helmet on the eve of battle and was thereafter identified with the golden flowers. His son, Henry II, is sometimes called Henry Plantagenet, that is, sprig of genista.

PALMETTO

The Palmetto or fan-leafed palm is a tree growing from 20 to 35 feet high on the southeast coast of the United States. Its leaves are made into hats, baskets and fans. The dwarf-palm abounds in South Carolina, which takes from it the name of the Palmetto State.

The hawthorn was similarly identified with the Tudor family, some say. A coronet cresting the helmet of Richard III, was found after his death on Bosworth Field in a hawthorn. It was used to crown Henry VII. A rose, however, in the pretty geometrical form so often seen carved on English royal property, is more usually connected with this kingly family, and has also become the emblem of England.

But the rose has always been notable in fable and history. The Pope gives a decoration of a Golden Rose to those whom he favours. Red or white, it figured as the badge of either of the contesting parties in the Wars of the Roses, and it is said that loyal Englishmen wear a rose on St. George's Day, April 23.

Most of us are undecided as to what is the emblem of Scotland. We hear of the heather on the moor and the "little harebells o'er the lea," and of the thistle; the latter, the badge of the Order of the

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Thistle and also of King James of Scotland, is the most important. Tradition has it that Danes attacking a Scottish camp were betrayed to the defenders by the gasp of a soldier who stepped on one of the spiny plants. Another armed plant is portrayed in the coat of arms of Mexico where a "Tuna," or prickly pear, is said to illustrate an ancient name of Mexico, meaning "fruit out of a stone," referring to the huge rock overshadowed by this common cactus on the site where the capital city was founded.

A branch of olive is grasped in one claw of the eagle on the Great Seal of the United States. The olive was very important in Pagan myth and religion, but "under Christianity," says M. D. Conway, "it became the emblem of peace chiefly because it had become, both in Greece and Italy, the favourite tree to mark the limits of landed property, probably on account of its almost imperishable durability." Laurel, on the contrary, signified triumph. Ovid remarks that at the founding of the Pythian Games

"An oaken garland did the victor crown,
The laurel was not yet for triumphs
borne."

The oak has always been a symbol of strength, as the palm is of victory. But the palmetto of South Carolina which appears so often, like the pine of Maine, or the maple of Canada, was probably chosen for other reasons than those of heraldic symbolism.

By far the most important "flower of chivalry" was the fleur-de-lys. "If any definite flower is meant," notes Ruskin, "by these triple groups of leaves — it is . . the purple iris." The device stamped as a city badge by the Florentines on coin and building, seems to have been taken to France by Crusaders, one legend saying that after one of the battles the banner which had hitherto been white was found covered with lilies. It was long the emblem of France, in gold on azure, and was carried thence to England by the mother of Edward III, that prince quartering the lilies "snatched from Gallia's Crown" on the Royal Arms of England, where they remained until 1801, signifying the claim of the Island Kingdom to that of France which was so long maintained.

"Say, Daphnis, say, in what glad soil
appears,
A wondrous tree that sacred monarchs
bears?"

So queries Pope, referring satirically to the Royal Oak at Boscobel into whose leafy boughs Charles II hastily climbed to escape his pursuers after his defeat at the battle of Worcester. In Pepys' time at least one ship and one tavern rejoiced in the name of Royall Oake, and there was a project to start an Order of that name. The date, May 29, was celebrated as Royal Oak Day, by wearing those curious spherical insect-galls known as oakapples. Perhaps the Connecticut colonists were thinking of this episode when they later hid their precious charter granted by this King in the cavity of that hollow tree long treasured as the "Charter Oak" of Hartford.

Britain has several memorial days on which flowers are worn.

A white rose was worn on the birthday of the Pretender, being thought to be the badge of the House of Stuart. The primroses appear in the buttonholes of members of the Primrose League on the anniversary of the death of Lord Beaconsfield, whose favourite flowers they were supposed to be. As we know, shamrocks, the trefoil leaves that claim to grow on the very plant chosen by St. Patrick to illustrate the Trinity, are worn on his day by ardent Irishmen, just as Welshmen flourish a green leek on St. David's Day.

Even the modest violet had its day, both the flower and its colour indicating a secret understanding among the friends of Napoleon (Père la Violette) before and after the escape from Elba. "From that time it remained the Napoleon flower, so much so that after Waterloo violets became seditious to wear — dangerous to sport in your buttonhole."

Ivy, the vine sacred to Bacchus, and a symbol of clinging attachment, which clasps "the fissured stones with its entwining arms," is creeping into history at this moment, for the story comes from over the seas that the Belgians are wearing sprigs of its evergreen foliage, since the German officials in charge of the country have forbidden them the use of their national colours for personal adornment.

THE GOLDEN GLORY OF THE BLOSSOMS OF THE BROOM HAS MADE THEM FAMOUS

OLD-WORLD OAKS APPEAR FREQUENTLY IN FOLK-LORE STORIES, MYTHS, AND RELIGIOUS BELIEFS

YELLOW PRIMROSES WERE SAID TO BE THE FAVOURITE FLOWERS OF THE ENGLISH PREMIER, LORD DISRAELI

COCHINEAL INSECTS LIVE ON THE PRICKLY-PEAR

AZURE HAREBELLS OF SCOTTISH LITERATURE

ONE OF THE WEEDS FARMERS DREAD MOST

SUPPOSED TO BE THE MODEL FOR THE FLEUR-DE-LYS

DAPHNE, LEGEND SAYS, WAS CHANGED INTO A LAUREL-TREE TO ESCAPE THE PURSUIT OF APOLLO

THE ORIENTALS WORE GARLANDS OF OLIVE AND BURNED ITS OIL IN THEIR SACRED FIRES

THE HAWTHORN IS A SHRUB FREQUENTLY MENTIONED IN EUROPEAN LITERATURE AS THE "MAY"

HEAVILY-SCENTED, SNOWY JASMINES ARE THE FAVOURITE FLOWERS FOR WEAVING INTO ORIENTAL GARLANDS

THE FLOWERS OF THE PHILIPPINE TREE, YLANG-YLANG, ARE HONEY-COLOURED, AND DELIGHTFULLY FRAGRANT

PLANTS THAT YIELD PERFUMES

THAT cry of the Roman poet, "Quick, roses — and more! Let it rain with the rose!" is echoed in the Balkans, for millions of the pleasant blooms, "dying too swiftly," are sacrificed there, not to make a Roman holiday, but for purely commercial purposes. Tons of the fragrant petals are required to make that precious attar which is said to have been discovered by a Mogul princess, when, wandering by a canal filled with rose-water, she curiously examined a floating, foamy scum and found it to be the very essence of roses drawn to the surface by the sun's rays.

Not only in the Balkans, but also in Southern France, about Grasse, are acres of roses and many other flowers cultivated for their scents. "Rosemary, thyme, lavender, geranium, roses and orangeflowers, are distilled with steam. The steam and extracted oil subsequently reassume the liquid form in suitable condensers, whence the oil is readily drawn off. The water distilled from the flowers, is conserved in receivers, for it is, of course, saturated with the valuable essence. There is rose-water, there is jasmine-water, there is orangeflower-water, literally sufficient to float a frigate." Some of these fragrant waters are redistilled and the essential oils taken away in more concentrated form, for they are practically insoluble in water; particularly is this the case with rose-water and orangeflower-water, from which attar of rose and oil of neroli are distilled.

A very up-to-date method dissolves the essences in "light petroleum spirit" and afterwards evaporates the spirit in a vacuum, leaving the essences in solid form. Certain rinds, as those of the orange, lemon and lime, are "expressed," or squeezed in a press; or they are rubbed in a spiked cup. But the most fragrance is said to be extracted, especially when the aroma is very delicate, or fugitive, from either the "hot" or "cold" enfleurage process; in the latter, blossoms, daily renewed, are laid on pure lard or other grease spread upon glass shelves in wooden frames, or upon cloth saturated with olive-oil; the former method consists of stirring the flowers in warm oil or grease. The fatty substances in both instances absorb the perfumes, which are later extracted from the oil or "pomade" by alcohol. The greater the purity of the result the greater the fragrance. These processes are used for such delicate flowers as jasmine, violet, tuberose, jonquil, cassie, hyacinths or lilies.

By one method or another, various woods, leaves, fruits, gums, resins and exotic flowers, contribute their odorous essences to the perfumer, soap-maker and incense-burner. The very names are fascinating,—frankincense and lignum-aloes; sandalwood, vanilla, patchouli, ylang-ylang and frangipani. Vetivert is another name for the khus-khus grass, whose fragrant roots are woven into heavily scented fans and mats. Other closely related grasses yield those oils called "citronella," abhorred by insects, and the "oil of lemon grass."

Bay rum is scented by the foliage of the bayberry of the West Indies, but our Colonial dames dipped aromatic candles in the pallid waxen coating of the bayberries along our Atlantic coasts.

Violets are so small, so difficult to pick, and give so little perfume, that the true essence is held at a fabulous price; but just as the oil of rose-geranium is substituted for, or used to adulterate, that of the rose, which it greatly resembles, so is the essence of cassie (sometimes called opoponax) or that of orris-root used for violet essence. The odour of these is quite like that of the violet, especially in the case of the orris-root. This is the scraped and dried root-stock of any one of several species of iris, but particularly of that silvery kind called Florentine. The hard waxy root must dry for two or three years before it is ready to be distilled or ground up into sachet powder, having then developed its characteristic odour.

Bits of this root are useful additions to that mixture of dried flowers and leaves which normally reposes in a huge Chinese jar, and is known as pot-pourri. Into it goes petals of such flowers as retain their scent after drying in the sun; roses and jasmine and pungent lavender that our grandmothers also loved to lay between folds of linen; bits of sweet woodruff or of sweet clover, or the yet more fragrant vanilla-grass, that gained its other name of Holy-grass by being cast beneath the feet of worshippers in churches, and which is woven by our Indians into the sweet-

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grass baskets whose odour of new-mown hay is so lasting. Rose-geranium and lemon-verbena, rosemary and spices, all help to give a tantalising fragrance.

Nowadays, a faint whiff of such aroma as is wafted from under the lifted lid of the pot-pourri jar, or from a delicate sachet, is all that is desired; but in olden days folks were not so fastidious; in fact, they rather affected strong scents capable of overcoming the unpleasant odours arising from the unsanitary surroundings. Mistress Quickly highly approved of her lords and ladies "smelling so sweetly (all musk)." For musk and castor and civet, rank animal odours, stored in the scent-gland of musk-deer, and beaver and evil-smelling civet-cat, were the vogue. With ambergris, found in whales, all of these are even now used in small quantities as bases for delicate perfumes, since they have a curious power of fixing more fugitive flower-odours.

All of these essences are expensive, and so scientists have found ways to duplicate or imitate them by chemical compounds, using coal-tar or cheap vegetable substances very unlike the flowers to which the perfume seems to belong. Although these odorous essences are thus made cheaper, they have not yet displaced those derived from natural sources, still in demand for the "ointment and perfume," which, according to Proverbs, "rejoice the heart." Some persons will always prefer the genuine to any imitation.

LAVENDER

The flowers have given their name to the colour that matches them. Lavender was sure to be found in those old fashioned gardens that grandmother loved, and the dried sprigs gave a delicious fragrance to the linen sheets stored in the mahogany linen chest.

THE JONQUIL IS A FAVOURITE PERFUME PLANT OF A PALE YELLOW COLOUR

THE LILY-OF-THE-VALLEY, ORIGINALLY WILD, IS SWEET AND POISONOUS

THE ANNUNCIATION LILY IS ALSO CALLED THE MADONNA LILY

THE FLORENTINE IRIS YIELDS THE DELICIOUSLY SWEET ORRIS-ROOT

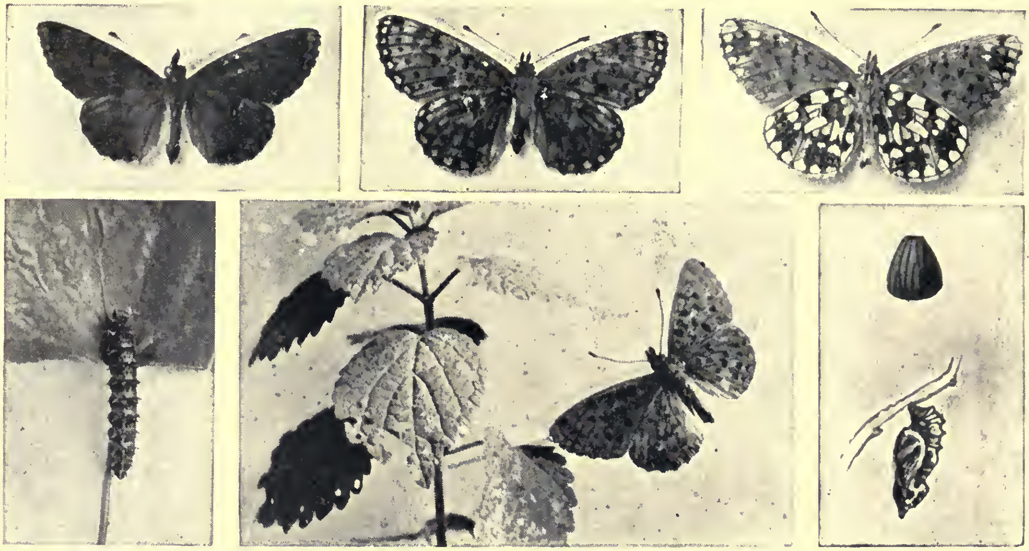
LILACS FORM DENSE THICKETS OF SPICY, SCENTED BLOOM IN OLD-FASHIONED GARDENS

HYACINTHS, DROOPING-BELLED, WERE SAID TO HAVE SPRUNG FROM THE BLOOD OF WOUNDED HYACINTHUS

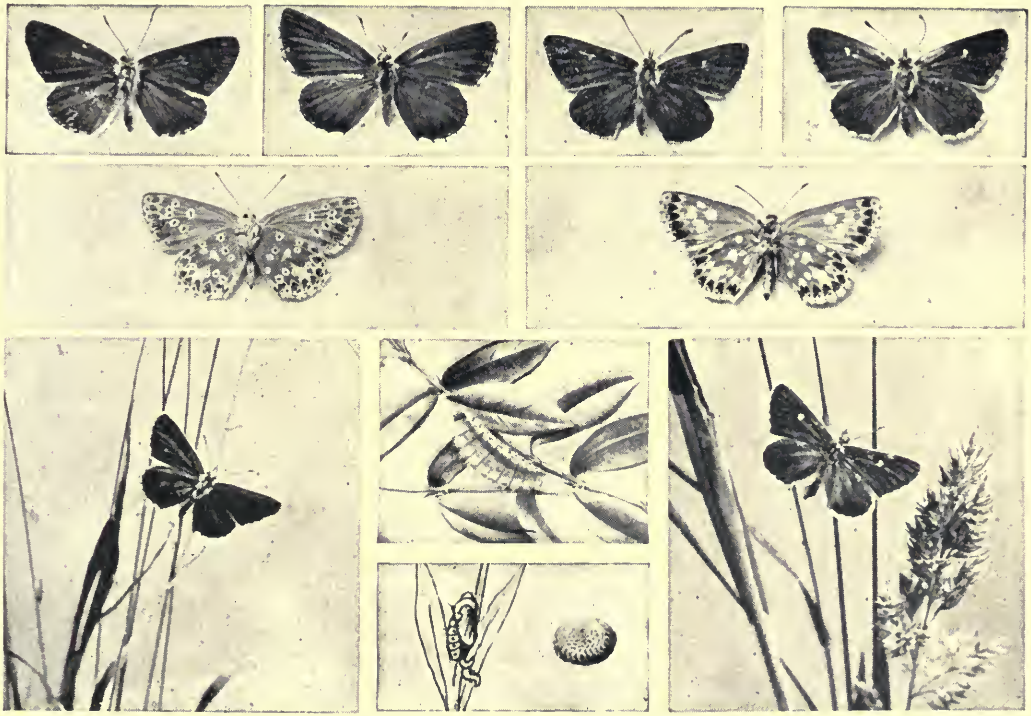
THE BUTTERFLIES OF SPRING

A NATURAL HISTORY GALLERY CONTAINING PORTRAITS OF COMMON BUTTERFLIES IN NATURAL SIZE

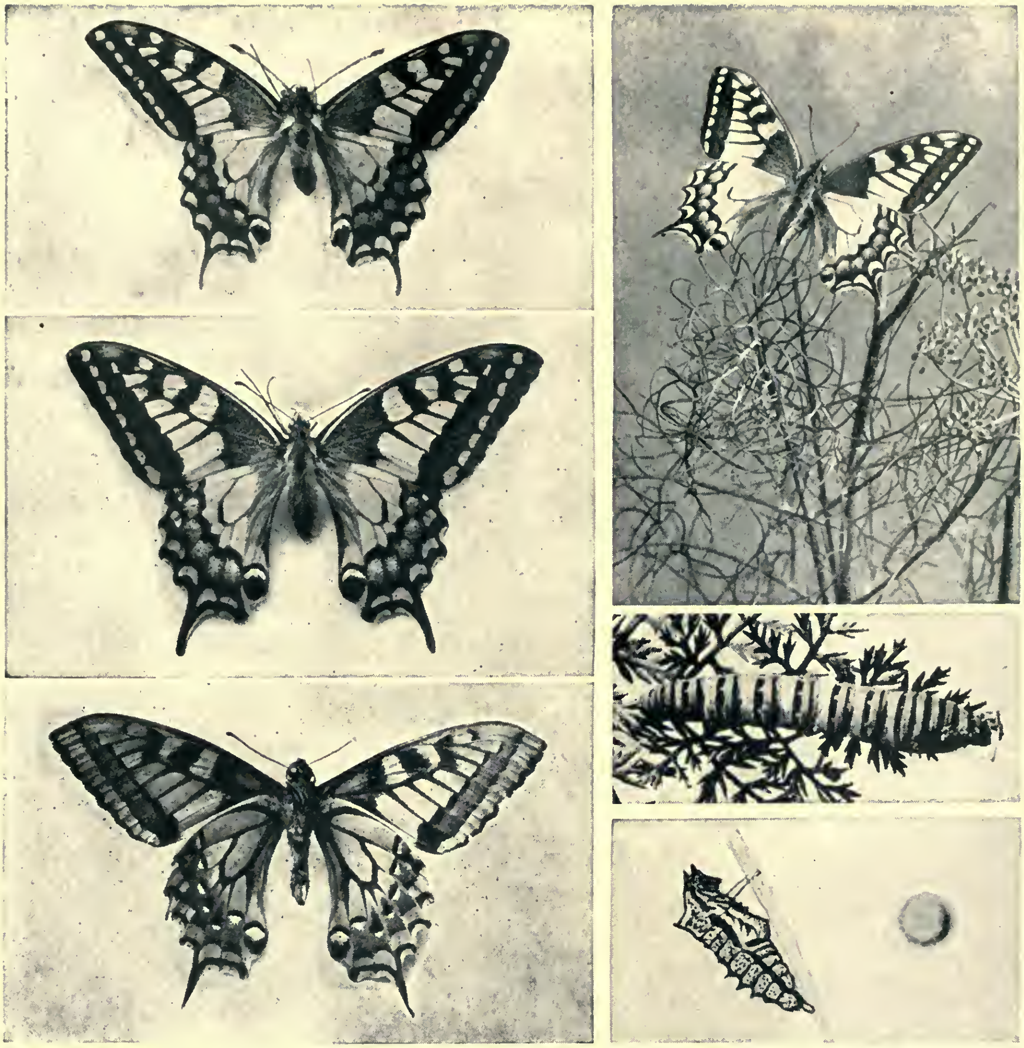
With seven pictures of each, showing (in this order) the male, female, and underwing of each species, the caterpillar on its food, the chrysalis with a microscopic view of the egg, and the butterfly resting on its favourite flower.



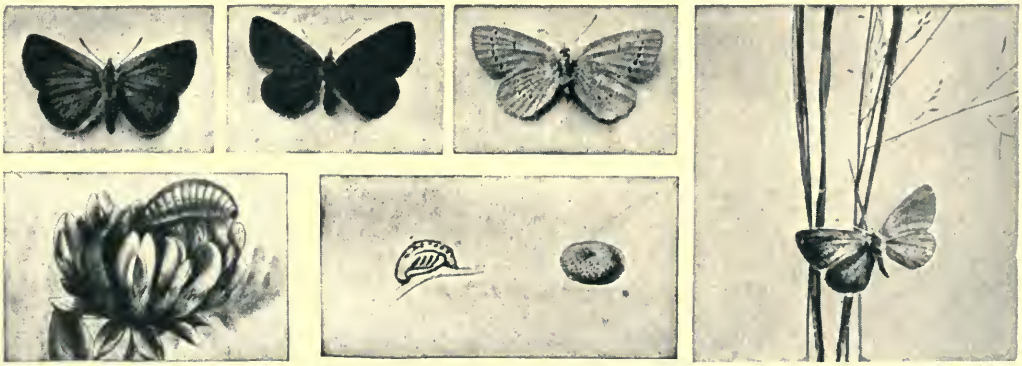
Small Fritillary. The fritillaries are all very much alike in their markings, and the name comes from a Latin word meaning a dice-box—an illusion to the spots. This is one of the smaller kinds, and it may be recognised from the fact that the under side has a tessellated pattern in red-brown, yellow, black, and silver, the silver spots numbering seventeen.



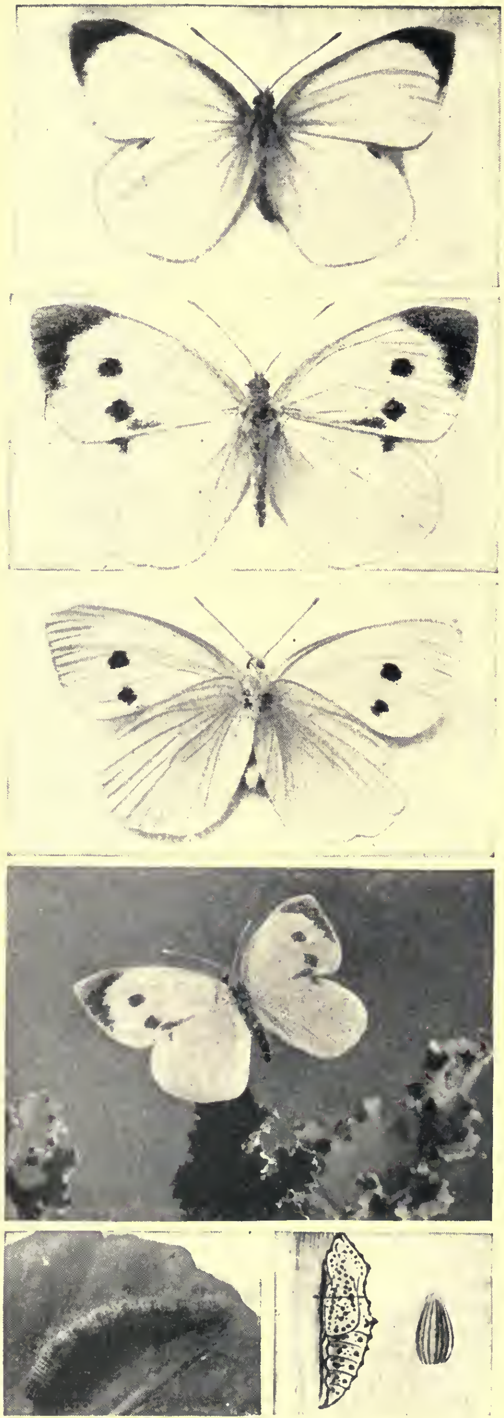
Checkerspots. These butterflies represent a group which is very large and widely distributed over all the cooler parts of the North Temperate Zone. In North America many species are to be found, but mostly on the western side of the continent. The colours are mainly brown and black, with a good deal of white in some species, and in others much bright red. These colours form a checkered pattern of red, black, buff, and rust brown, which is very beautiful. The caterpillars are spiny and variously coloured, and feed upon the leaves of many garden plants.



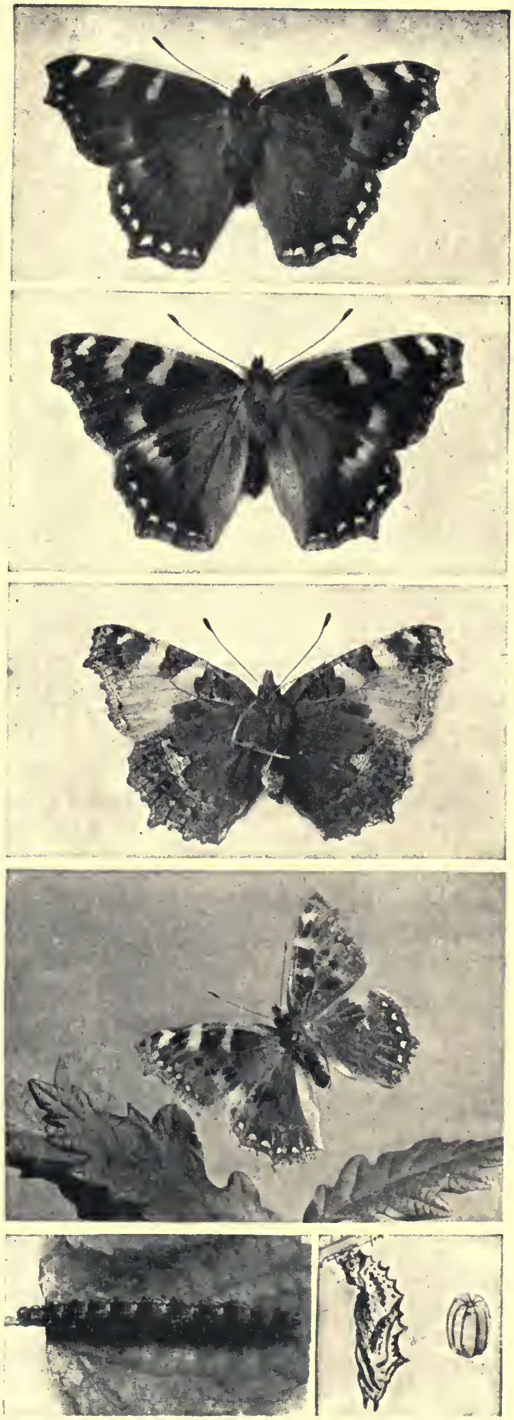
Swallowtails. These pictures represent four kinds of swallowtailed butterflies, among the largest and most gaudy of our American papilios. All are black and yellow, with blue touches near the outer margins of the wings, and touches of red on the "tails." The caterpillar in this group is smooth, and is banded in yellow and black; and the chrysalis, which is grass-green, is slung to its support by a loop of silk.



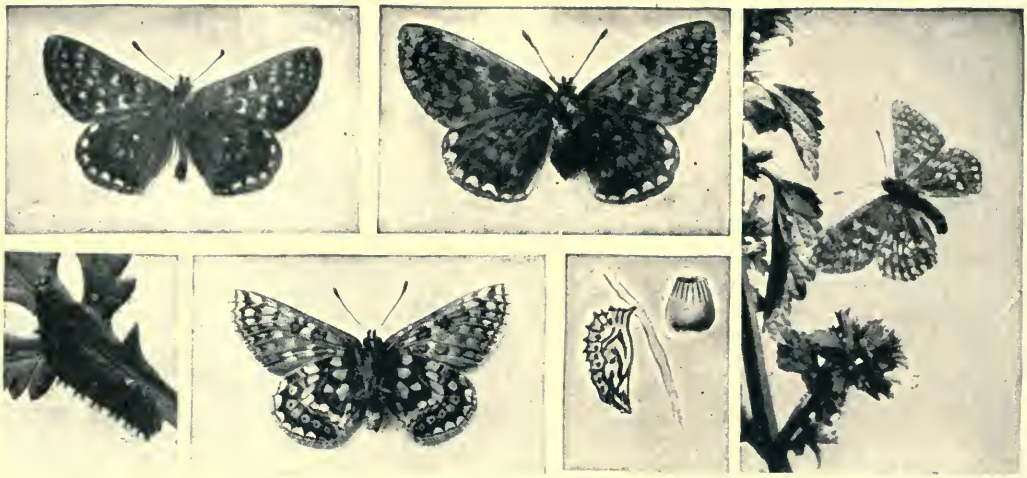
The Blues. This group of cuts represents the Blues, a large genus (Lycæna) of small grey-blue butterflies often seen flitting in little companies above the roadway or lawn. The colouring of the wings varies much, but generally the upper side is smoky brown tinged with silvery blue. The under side is silvery grey, with greenish-blue at the base and a series of small black spots.



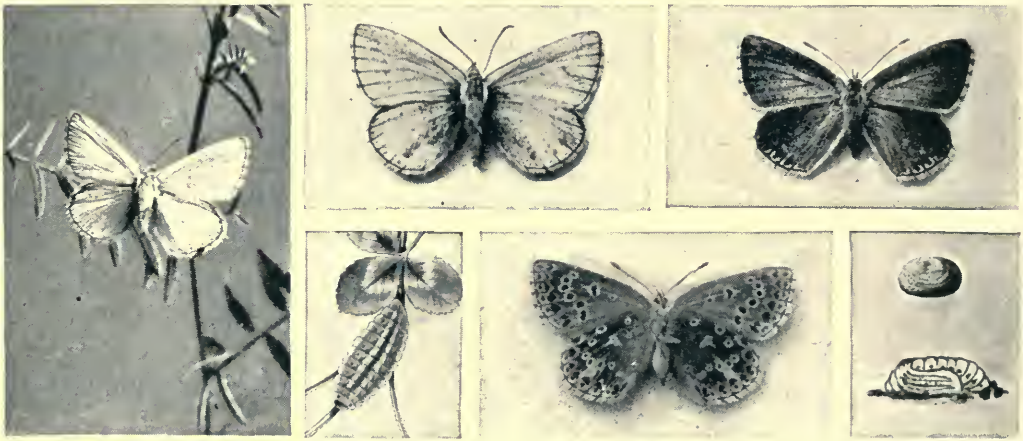
Large White. The large garden, or cabbage, white butterfly is one of the most widely spread of butterflies. It is seen in all parts of the country, and, being double-brooded, occurs from May to September. It is white, and has a large black patch at the apex of each fore wing, the female having also smaller patches in the middle of each wing. The caterpillar is green, with yellow stripes, and feeds on cabbages and similar plants.



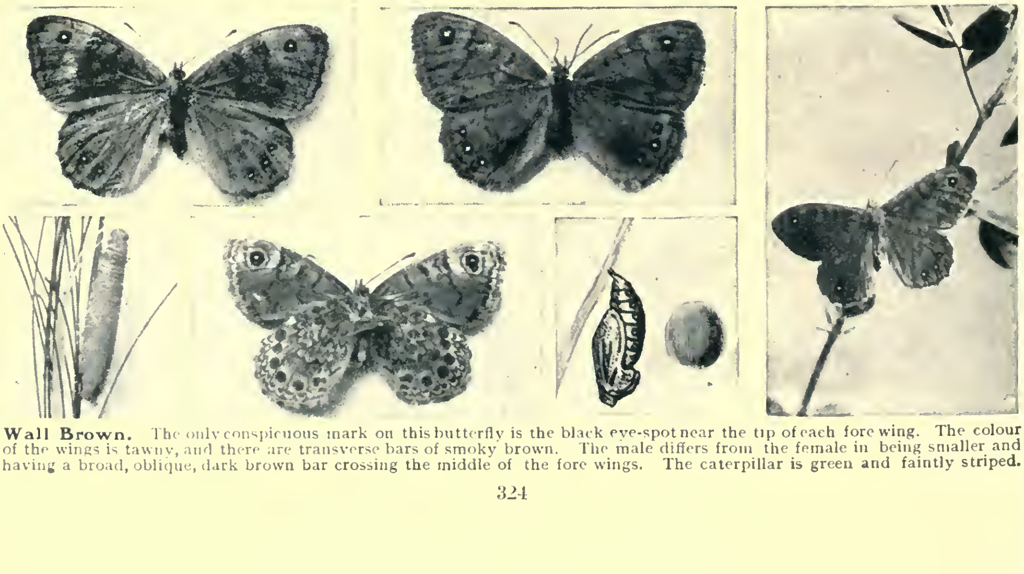
Small Tortoiseshell. When this butterfly is seen on the wing or at rest its name is easily understood by the resemblance of its markings to tortoiseshell. It is a handsome specimen, and its colours are brighter than those of the large tortoiseshell. It appears in July, but specimens often hibernate and come out in spring. The caterpillars, which are yellowish with a greenish line down the middle of the back, live in companies.



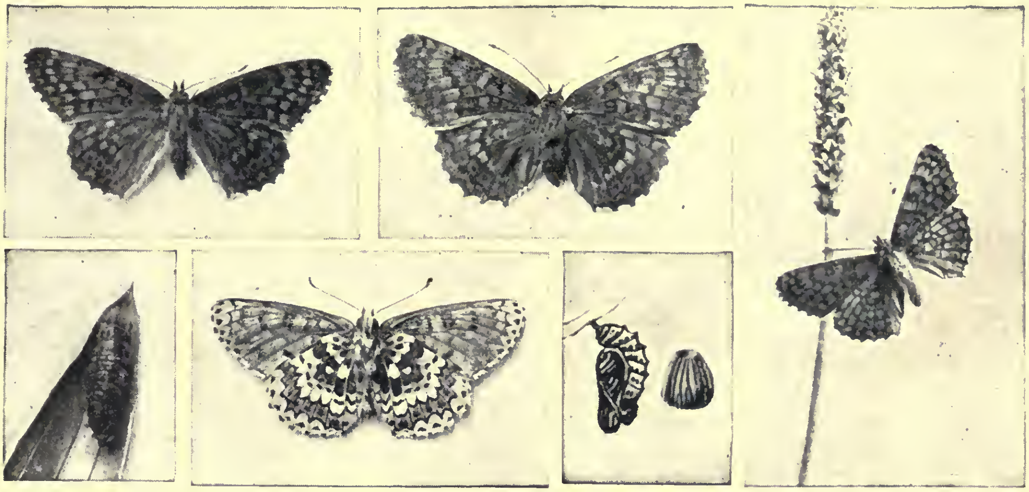
Greasy or Marsh Fritillary. The name greasy fritillary was given to this butterfly on account of the shiny appearance of the underside, which may be said to be somewhat suggestive of grease. The wings here are brown, with straw-coloured markings. On the upper side the appearance is very similar, though the colours are darker, some of the markings being black. The caterpillar is black and spiny, with yellowish dots, and it changes into a pale green chrysalis dotted with black.



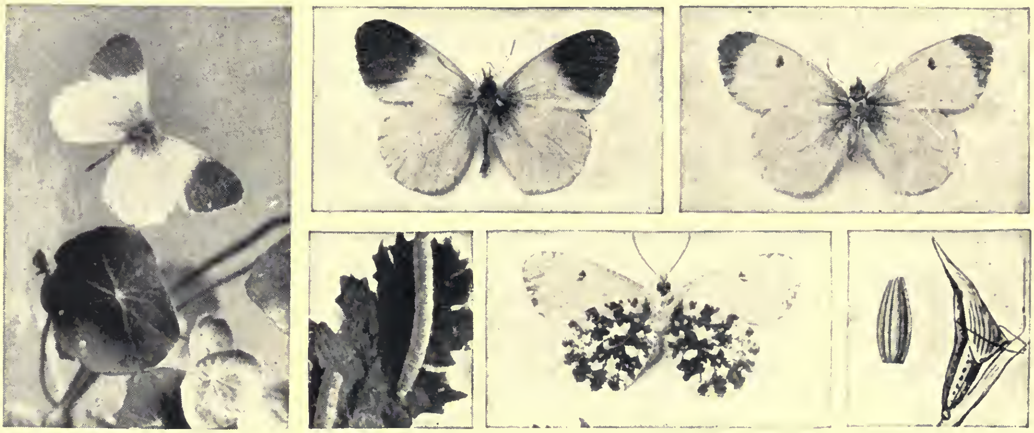
Clifden Blue. Though not the largest this is the most brilliant of all the blue butterflies, so far as the male is concerned. His wings are a very bright azure blue, but those of his mate are dark brown tinged with blue. She has on her wings a margin of orange and black spots and a fringe of white with black spots. On the underside the Clifden blue is greyish brown in colour.



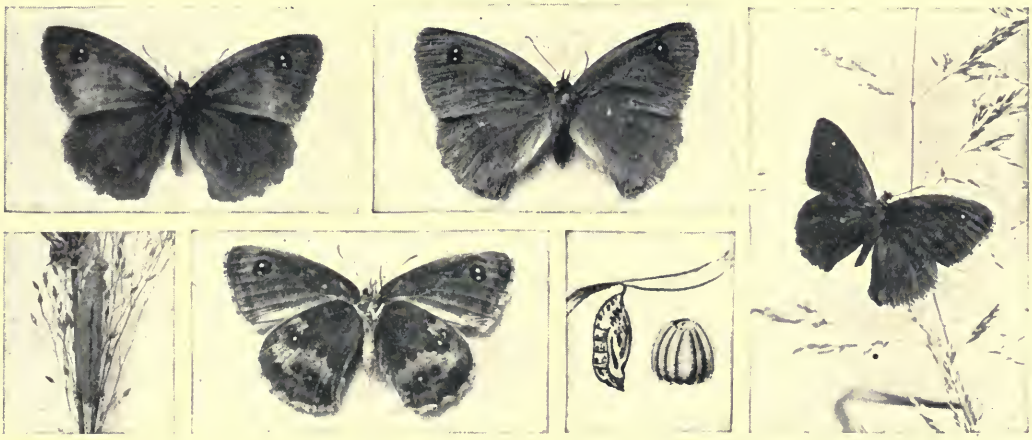
Wall Brown. The only conspicuous mark on this butterfly is the black eye-spot near the tip of each fore wing. The colour of the wings is tawny, and there are transverse bars of smoky brown. The male differs from the female in being smaller and having a broad, oblique, dark brown bar crossing the middle of the fore wings. The caterpillar is green and faintly striped.



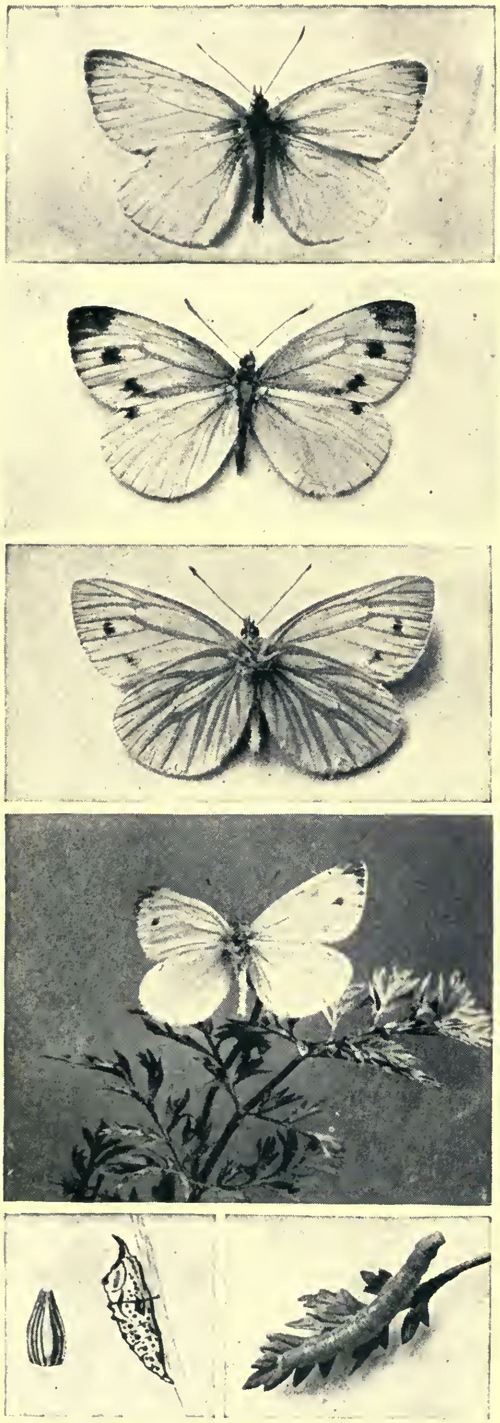
Glanville Fritillary. In shape and colour this is a very peculiar example of the large fritillary group. It is now found practically nowhere but in the Isle of Wight, though formerly it was fairly common through England. The black, bristly caterpillars live in colonies, and feed upon the hawkweed, plantain, and speedwell, and the light grey chrysalids are plump.



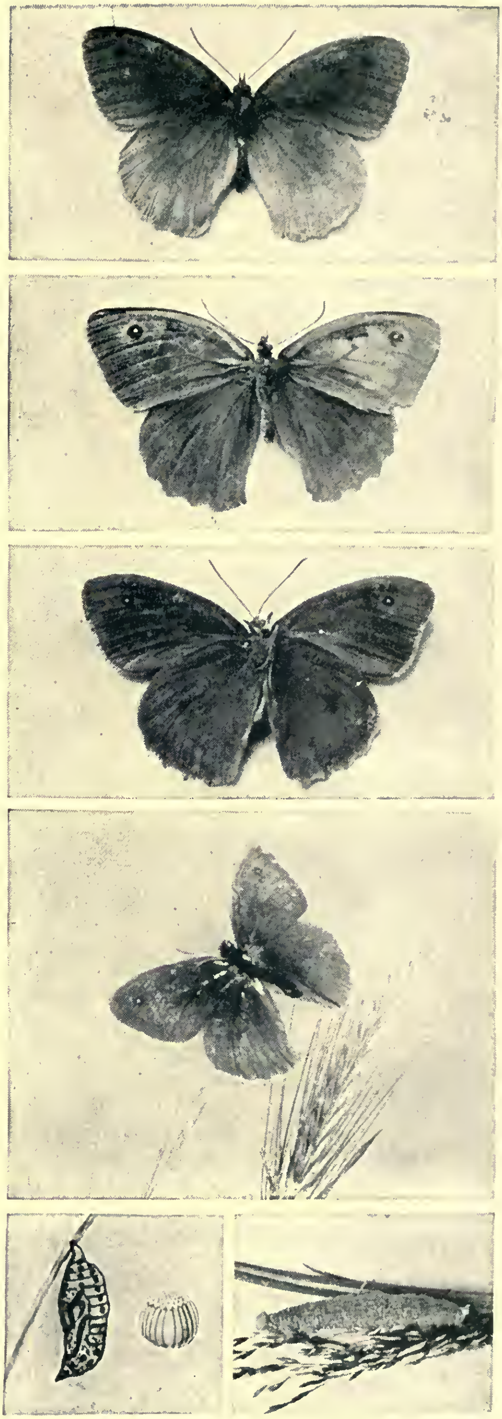
Orange Tip. Although not brilliant, this butterfly is certainly striking, and it can never be mistaken, for the decided orange on the tip of the wings always catches the eye. The female, however, has no orange at all. The underside of the hind wings is marbled with green and white. The bluish-green caterpillar has very tiny black dots, and there are white stripes on the side.



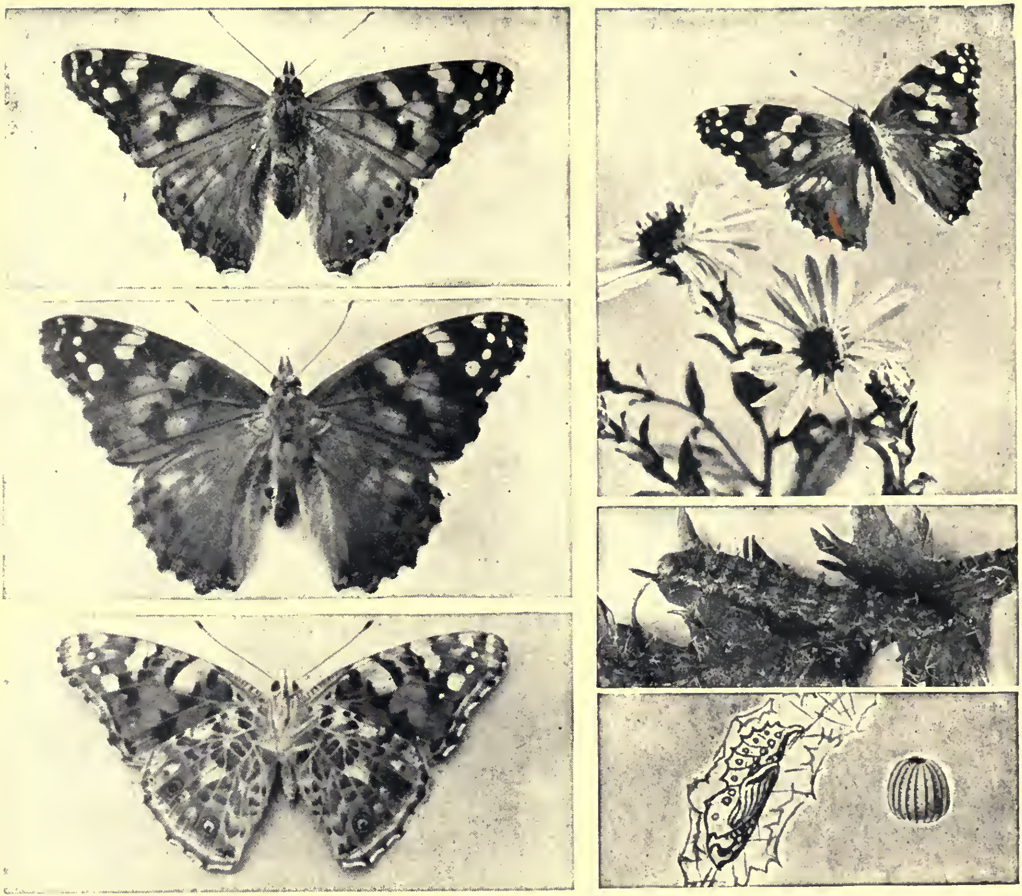
GateKeeper. There are various other names for this butterfly, such as large heath and small meadow brown. The wings are brownish orange with tawny margins, and near the apex of each fore wing is a black eye spot containing two white dots. The male is smaller than the female. The caterpillar is brownish green in colour, and the angular chrysalis is greenish grey.



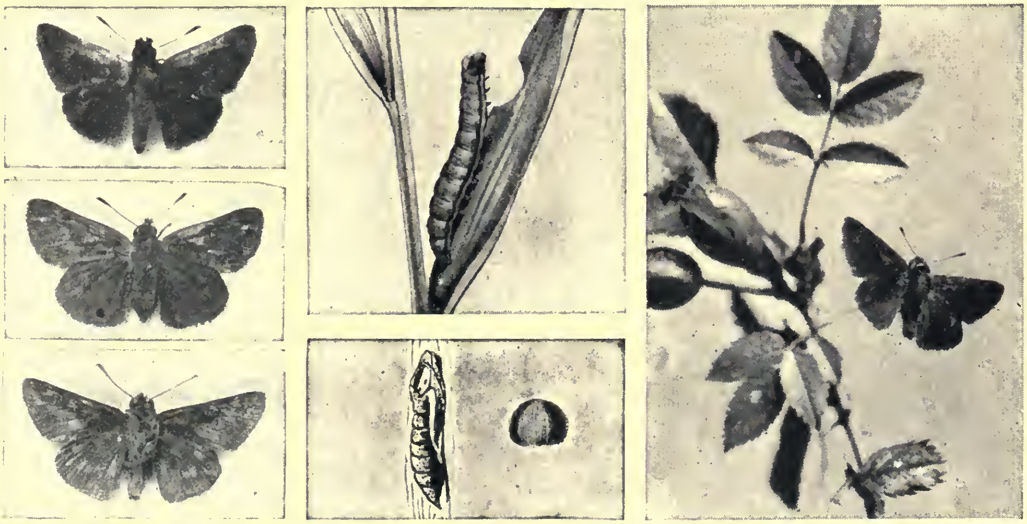
Green-Veined White. On the edges of woods and in country lanes where it flies, the green-veined white is not very conspicuous, and it may easily be mistaken for the small cabbage white, to which it is closely related. The name comes from the dull green markings of the underside of the hind wings. The caterpillar, which feeds on cabbage, is dull green with black markings, and the yellowish-green chrysalis has black dots.



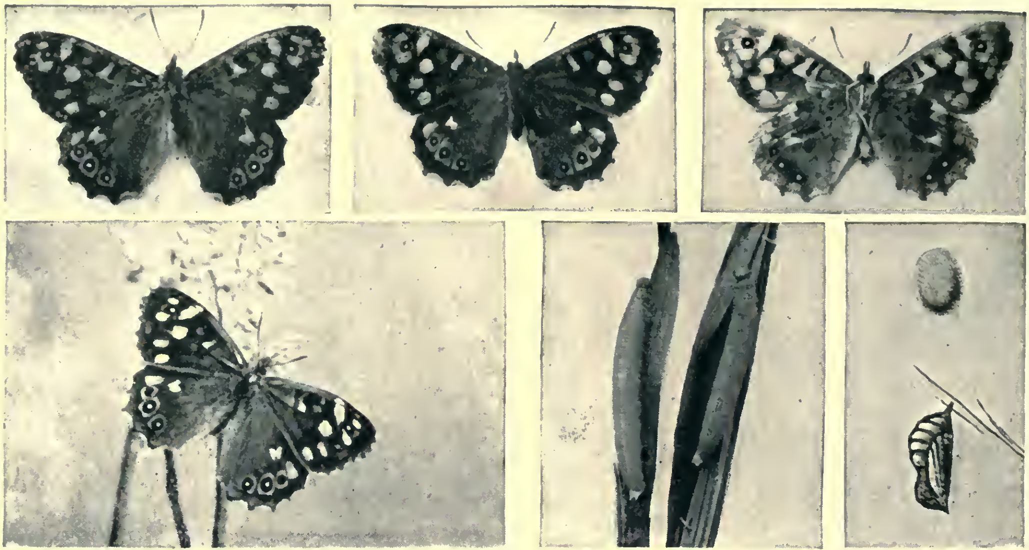
Meadow Brown. Of all our brown butterflies this is perhaps the least attractive. It is a dark smoky brown in colour, the only relief being provided by a white-pupilled black eye-spot in the tip of each fore wing. The female is lighter, and has more pronounced eye-spots on light yellow bands. The brownish-grey caterpillar hides during the day under stones on the ground, and comes out in search of food at night-time.



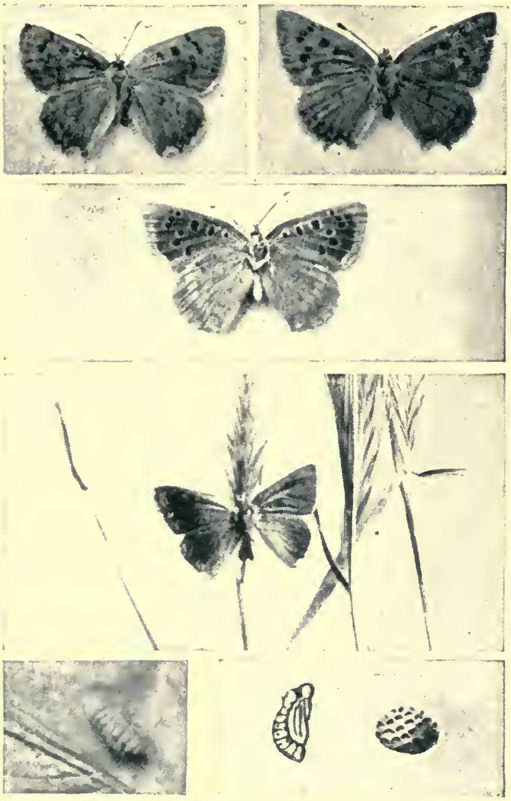
Painted Lady. This butterfly represents the large red-brown, handsomely marked butterflies of the genus Argynnis, common in America. It emerges in August, hibernates, and flies out in April or May. The wings are scalloped, and the general colour is a tawny orange relieved by black and white spots. The dark grey caterpiliar has yellow stripes and spots.



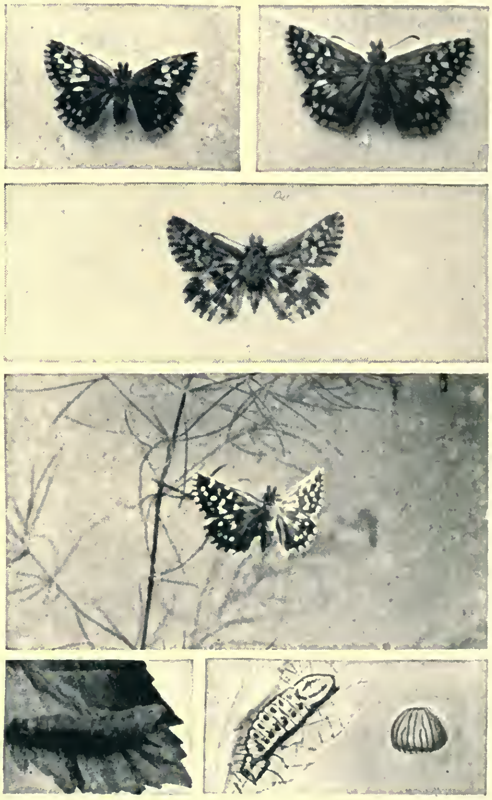
Large Skipper. The wings are brown, with lighter tawny spots and dark margins, and in the female the spots are lighter and the margins darker. It is common in lanes and woods, where it may often be seen on the leaves of bushes, with its wings closed up and the greenish-tawny underside showing. The caterpillar is dull green, with yellowish lines and black dots.



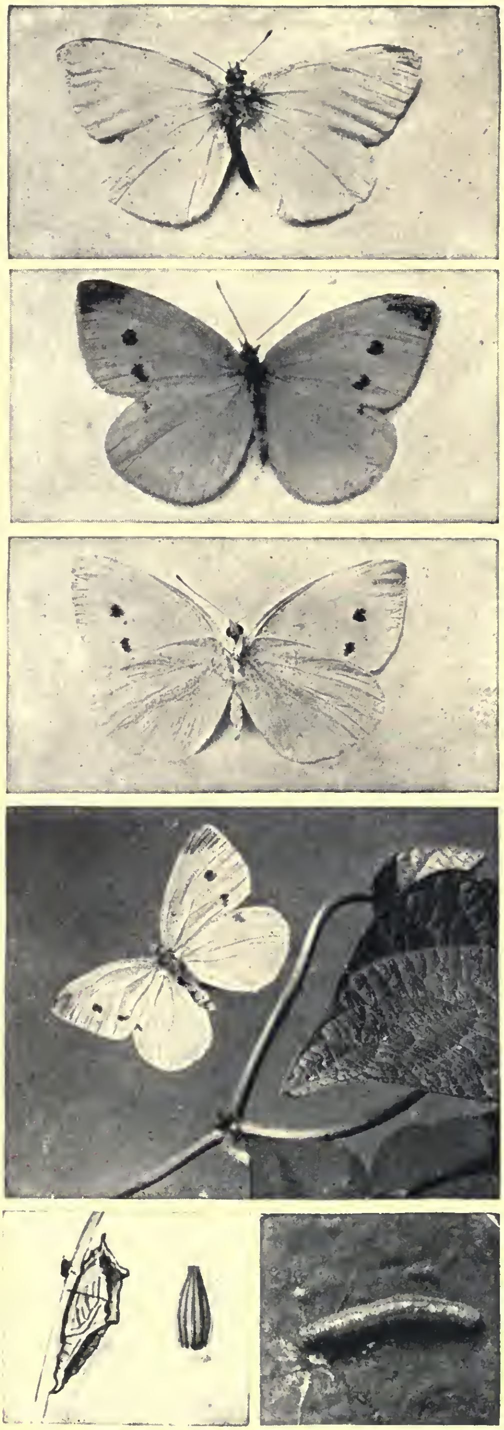
Speckled Wood. This butterfly, which is sometimes called the wood argus, is fairly common all over the country. The rounded and scalloped wings are brown, with pale buff spots on the upper side. The dull green caterpillar changes into a chrysalis at the beginning of April, and the butterfly appears a week or so later. The eggs are laid on the stalks of grass.



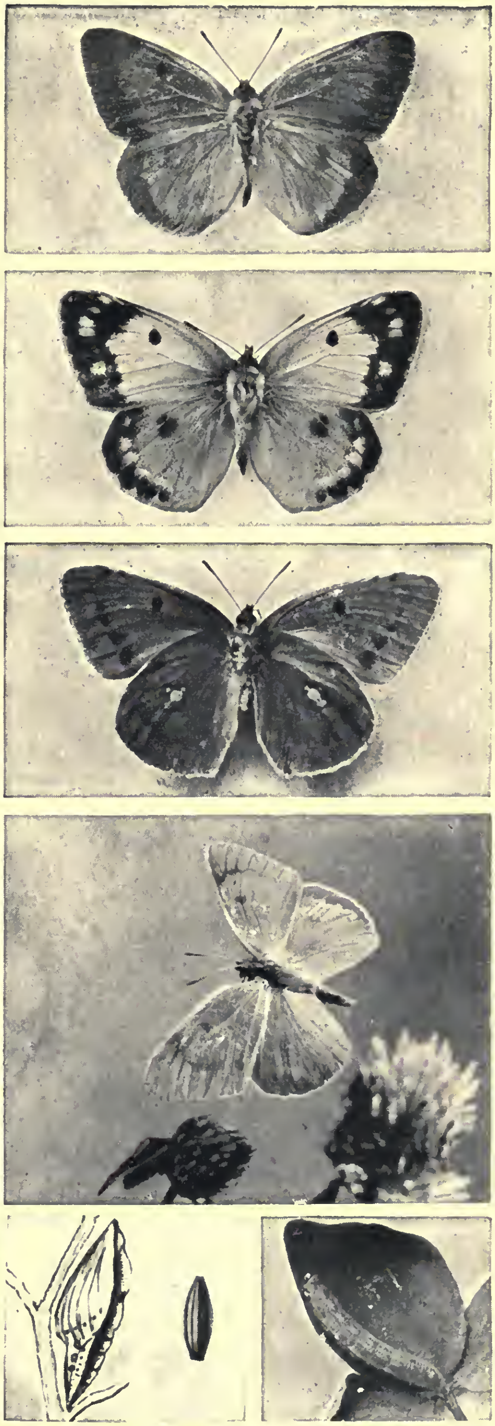
Small Copper. About the same size as the common blue, the small copper is a very dainty little butterfly, its fore wings of shining coppery red, with dark margins and spots, showing up well in the sun. The hind wings are almost black, with copper margins. On the underside the colour is tawny and grey, with dark spots. The tiny caterpillar is green, and has a brown line down the back and sometimes has pink stripes on its sides.



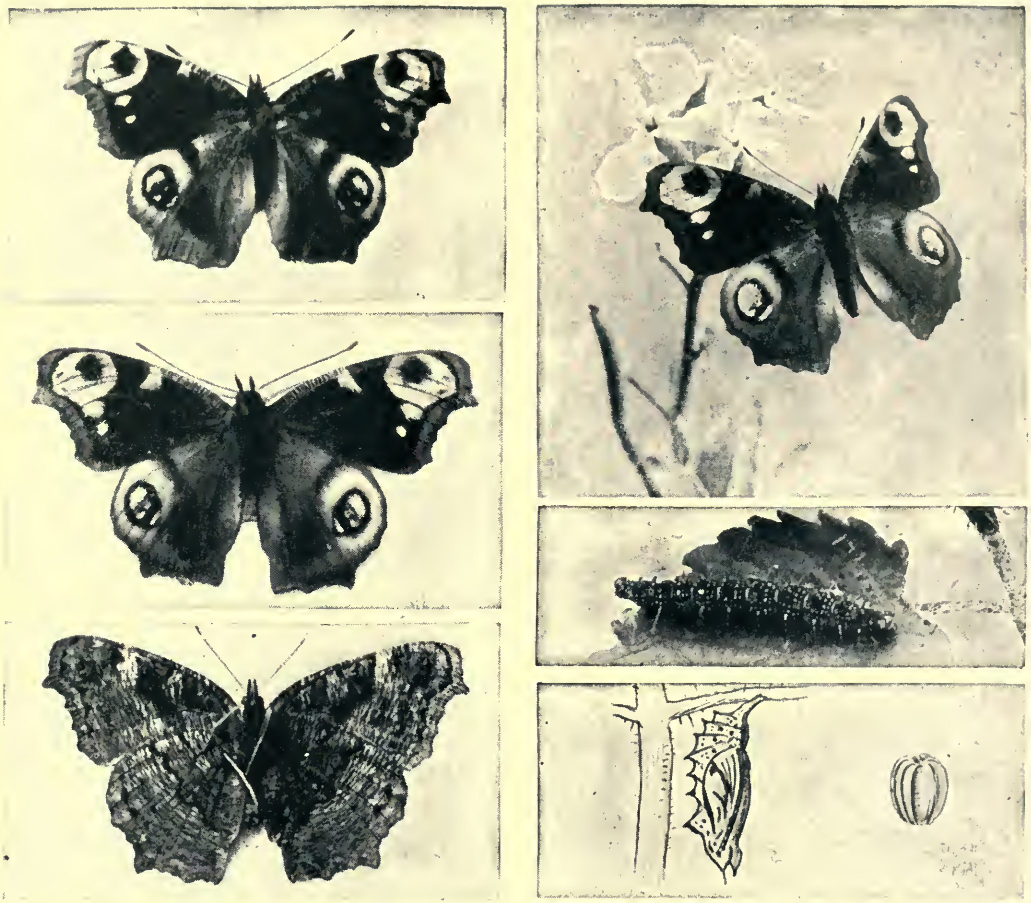
Grizzled Skipper. The smoky black colour of the grizzled skipper's wings is relieved by a number of white or cream-coloured spots, and the margins have a check pattern. It lays its eggs on the common bramble, and these hatch out into little green caterpillars with yellow lines at the sides. The chrysalis is brown, with bluish markings, and it rests in a cocoon between the leaves. The butterfly emerges from the chrysalis in June.



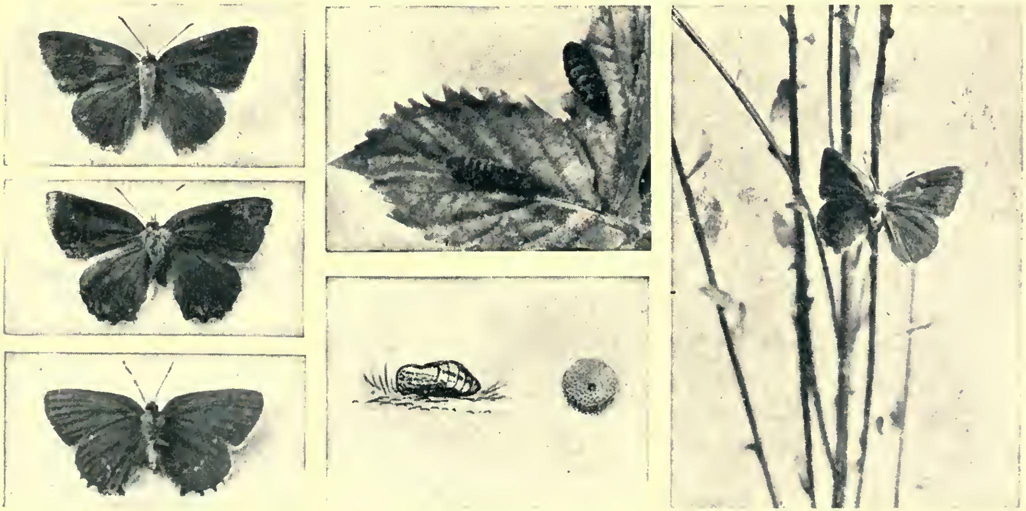
Small White. There is no mistaking the small garden, or cabbage, white butterfly, for it is the most familiar of all our butterflies. Even in town gardens it is quite common. The green caterpillar, which has yellow lines on its body, feeds on the soft hearts of cabbages. Brood succeeds brood from April to August, and the caterpillars often work great damage.



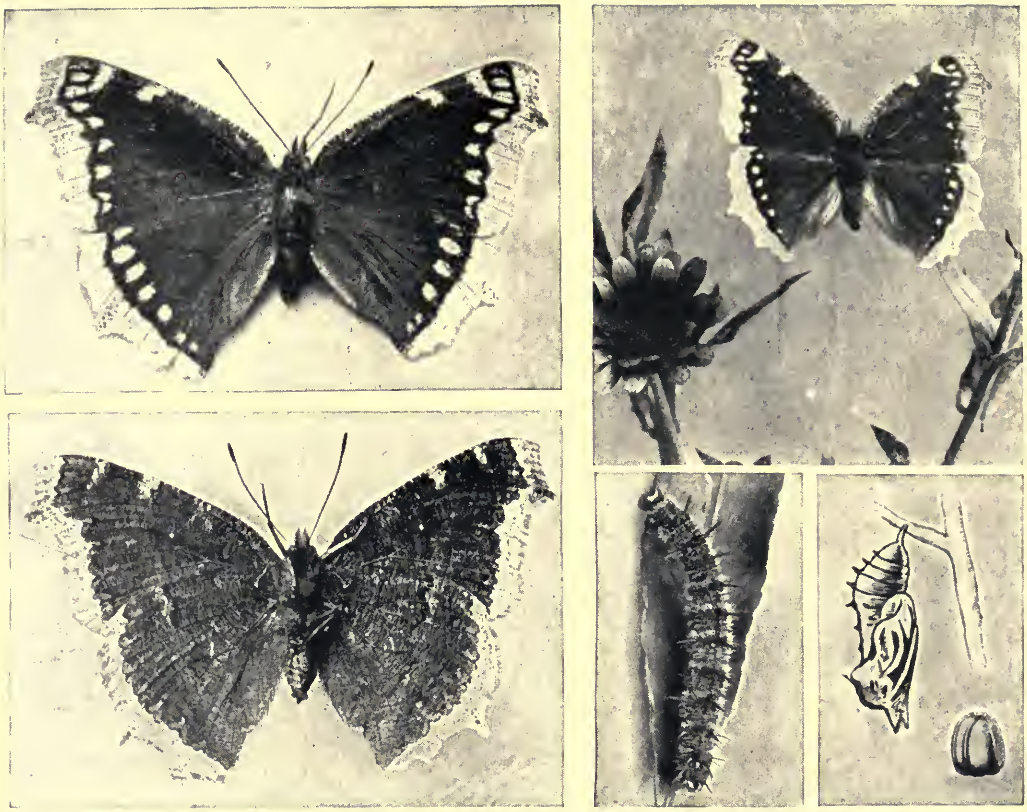
Clouded Yellow. This butterfly is easily distinguished by the brilliant saffron-yellow of the wings, which colour is emphasised by broad black margins. Each fore wing also has a black spot. On the underside the colour is paler, and the margins are spotted. The caterpillar is green, with a white stripe on each side and a pink or red spot on each segment.



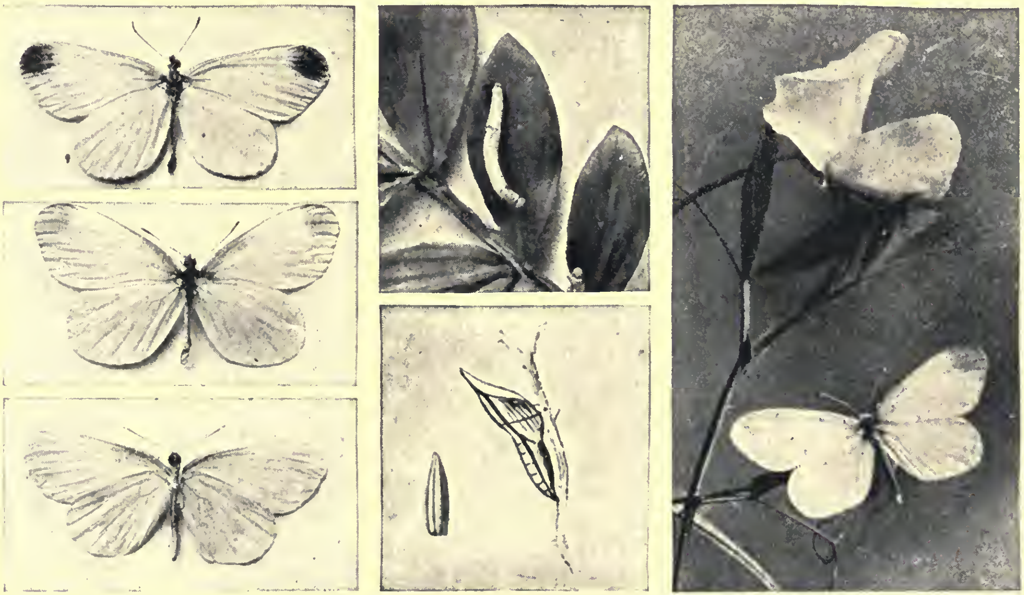
Peacock. The beautifully marked peacock gets its name from the peacock-eye on each of its wings. The underside is black, sometimes speckled or streaked with grey, and the caterpillar, which usually feeds upon the stinging-nettle, is black with white dots and reddish legs. The butterfly emerges from the chrysalis in July, but it hibernates and also appears in the spring.



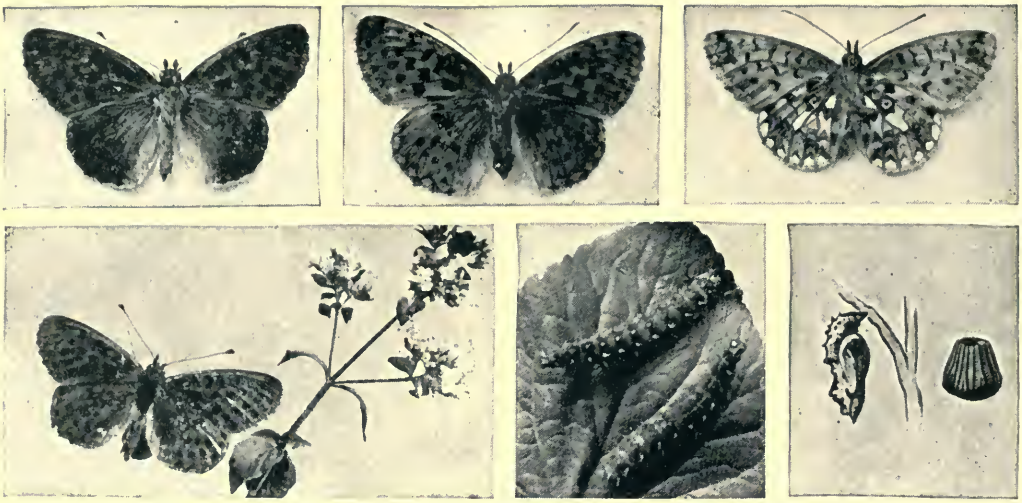
Green Hairstreak. The scalloping of the hind wings of this butterfly is very marked, and is emphasised by the chequering of the margins, which is almost the only relief on an otherwise uniform brown. On the underside the wings are green, hence the name of the creature. The caterpillar, green, with yellow stripes and whitish spots, feeds on the buds and blossoms of the bramble. It changes into a brown chrysalis about July or August and hibernates, and the butterfly emerges in May.



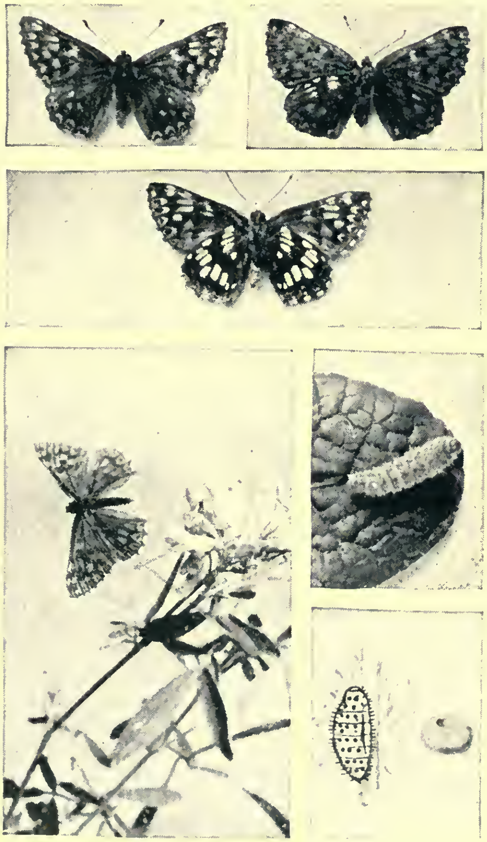
Mourning Cloak. Though not the most showy, this is the most beautiful of butterflies, and it exists also in Europe, where it is known as Camberwell Beauty. Male and female have rich velvety wings of deep purplish-brown, and margins of black, ornamented with a row of violet-blue spots. Beyond this margin is what appears to be a silky fringe of pale yellow. The under side is black, with white borders and spots. The caterpillar is black, with red spots and legs.



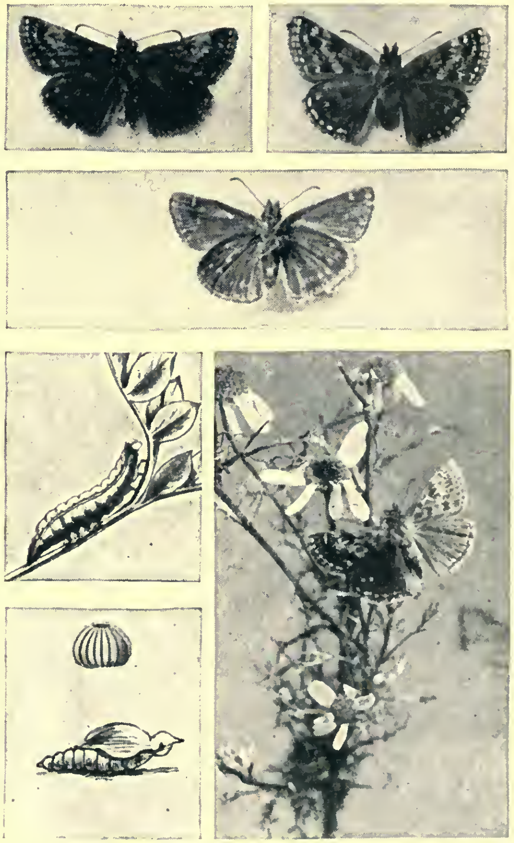
Wood White. This is not so conspicuous as the other white butterflies, for it is small, and it frequents the shady glades of woods. The wings are white, with a black blotch at the tip of each fore wing, and these marks are grey in the female. Underneath, the wings are a greenish-grey colour. The caterpillar is green, with black dots and a yellow stripe at each side.



Pearl-Bordered Fritillary. Between this and the small pearl-bordered, the size and markings differ very little, but this species is lighter. On the underside there are nine silver spots. In May the female butterflies lay their eggs on the leaves of the dog-violet, and these hatch out in June into velvety caterpillars that are black, with bluish-white dots and stripes.



Duke of Burgundy Fritillary. The eggs of this butterfly may often be found laid on the underside of the leaf of the cowslip or primrose. Sometimes they occur singly, and at other times in clusters of four or five. The olive-brown caterpillar changes into a yellowish-brown chrysalis, with black dots, and in May the tawny butterfly with the fritillary markings is on the wing. But it is not one of the fritillary family.



Dingy Skipper. The name is very appropriate. for the colour of this creature is probably the dingiest of all American butterflies. The wings are brown, with bands of darker brown and grey, and a row of lighter dots on the margins. Underneath, the ground-colour is a greyish brown, and there are dull yellowish spots. Specimens vary, however, very much. The caterpillar is attractive, being bright green with yellow stripes.

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